The Bradshaw Lecture

ON

NEPHRECTOMY, NEPHROLITHOTOMY, AND LITHOTOMY.

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MR. PRESIDENT AND GENTLEMEN,—Permit me, before commencing my address, to express to you, however inadequately, my deep sense, shared, I am sure, by everyone here present, of the enormous loss our profession and the entire community have sustained in the death of our late President, Sir Wm. MacCormac.

The whole world knows how, at the call of the Government, he faced the dangers of the South African battlefields in order to place his unrivalled experience at his country's service, at a time, too, when he might well have claimed his right to rest.

Who can estimate the sum of consolation carried by this act of patriotism into the innumerable anxious homes throughout the length and breadth of the land? We alone who have been brought into close contact with him within these walls can appraise the value of his work on behalf of this College. No man has had its interests more at heart, none been more ready to place time and labour at its disposal.

To us it is a consolation to know that he has died honoured alike by his Sovereign, his professional brethren, and the people.

The generous founder of the Bradshaw Lecture exercised, I think, a wise discretion in permitting each individual lecturer to select his own subject, placing no further restriction upon him than that he shall not range beyond the realm of surgery. Such liberty of choice would seem admirably calculated to afford opportunities for the appointed lecturers to place before their colleagues matured opinions upon subjects in which they may have been specially interested, or may perchance have obtained wide, if not exceptional, experience.

Our late distinguished President, when asking me to undertake the task for this year, must chiefly, I feel sure, have intended to do honour to the large and well reputed hospital with which I have for many years been connected, and yet whilst fully recognising this, I desire to place on record my high appreciation of the compliment paid to myself.

I have hesitated somewhat in my desire to say something concerning the surgery of the kidney; our colleague, Mr. Morris, having recently published so complete and masterly a work on this subject as to leave little unsaid. On most questions, however, and especially on those of recent origin and development, there is room for personal experience, even if the outcome be no more than to confirm what has been observed by others; nay, more, it is only by the accumulated experience of many that such works as Morris's are rendered possible, and so it becomes a duty for each of us to make what addition we can to the common stock. I will not therefore apologise for offering my small contribution to so large a subject, but will claim that in so doing "I've done my duty and I've done no more."

My first essay in renal surgery dates back to the winter of 1869-1870, and as it exhibits a combination of boldness with timidity, which not inaptly exemplifies the surgery of that date, I will not hesitate to make confession of it. It was about this time that M. Dieulafoy had introduced to the profession his well-known "pneumatic aspirator," an instrument which early came into very general use, and by means of which surgeons were emboldened to evacuate and examine the contents of cavities and swellings hitherto most frequently reserved for *post-mortem* examination. Few diagnoses indeed were considered complete which did not include the information to be obtained by means of this instrument.

A dispensary patient, pale and emaciated from a long-standing pyuria, was brought under my notice, in whose right loin could be plainly felt a

large swelling, firm, fixed, and elastic. A diagnosis of abscess in the kidney was confirmed by an obvious diminution in the urinary sediment after several ounces of pus had been evacuated through the loin by means of the aspirator needle. The suppuration along the needle track which ensued led me to freely incise the loin and the subjacent kidney, the dilated calices of which were readily felt by the finger introduced through the incision. No foreign substance was felt, nor was any diligent search made. The after-treatment consisted of the inevitable linseed poultice, and the results, I need hardly say, were pyæmia and death. In addition to the pyæmic foci of recent origin, the necropsy revealed nothing more than a kidney converted into a thick-walled sacculated bag of pus, in which was imbedded a phosphatic-coated uric acid calculus of considerable size. Of the early history of this patient I have neither note nor recollection. Probably it was less eventful than the extent of mischief would seem to imply.

NEPHRECTOMY IN CHILDREN.

The result warned me off the kidney, and increased the superstitious dread, which I shared with the profession at large, of meddling with so vital an organ. These, too, were the preantiseptic days, for although Lister had been labouring hard for some years to secure the acceptance of his doctrines respecting the origin, causation, and prevention of surgical inflammation, it was not until about the year 1870 that he obtained anything like a general adhesion to his teaching; and it is not too much to say that had it not been for Lister's discoveries, there would in all probability have been even now but little advance in renal surgery upon the sample I have just related. It was not, indeed, until late in the Seventies that surgeons made any serious attempt to bring the kidney within the range of their treatment. Mr. Morris tells us that he was the first to undertake a nephrolithotomy, and his operation took place in February, 1880. Simon, of Heidelberg, is credited with having been the first intentionally to perform a planned nephrectomy in 1869; and in these early days Dr. Meadows and Mr. Durham in this country, and others abroad, have reported cases in which the operation was either completely or incompletely performed, albeit on a mistaken diagnosis. In June, 1877, I undertook my first nephrectomy.

The patient was a child, aged 2 years and 3 months, who for several months had been passing bloody urine, and whose condition was one of pallor with some wasting. In the left loin an increasing mass of considerable size easily defined and possessing some slight degree of mobility, had been under observation during several weeks. The operation consisted of an incision in the loin, commencing a fingerbreadth from the vertebral spine and carried midway between the costal margin and the iliac crest to an extent sufficient to allow of the insertion of the fingers and thumb. On careful division of the muscles, the capsulated tumour was exposed, and its separation from surrounding tissues, together with that of the kidney from which it sprang, was easily effected. The whole of the pedicle, containing ureter and blood vessels, was secured in a double ligature of hemp, and the mass, severed from its pedicle by scissors, was removed. The growth, which involved a considerable portion of the renal structure, is described in the notes as encephaloid. The immediate recovery of the child was complete and satisfactory; but the respite was not of long duration, inasmuch as during the ensuing autumn the child died with unequivocal signs of a return of the disease beneath the site of the operation. Owing to my absence from home the body was not examined.

These details may be of some interest from the fact that this was, so far as I am aware, the first nephrectomy undertaken of set purpose in this country, and for the additional reason that the general outlines of the case as here given do not differ materially from those found in a large majority of the cases of sarcoma of the kidney in young children, of which this was probably an example. Eight similar cases have come under my own observation, in which, with variations only in age—the youngest being 13 months and the eldest 5½ years—in the size and duration of the tumour, and in the general condition of the patient, the description I have given would apply equally. Nor have I in the later cases materially altered the mode of operation. The incision has been made somewhat nearer the last rib, and has been lengthened when necessitated by the size of the tumour; silk ligatures have been substituted for the hemp, and greater care has been exercised in establishing and maintaining complete asepticity of the wound. One little patient died under operation from loss of blood and shock; the rest recovered from the effects of the operation.

Walsham in Morris's *Treatise of Anatomy* points out the danger, when performing nephrectomy on the right side, of including within the ligature a portion of the vena cava. Once this actually occurred in my hands, and on another occasion my previous experience alone enabled me to avoid a like catastrophe.

The first of the two cases was that of a female, aged 2 years and 10

months, sent me in June, 1883, in whose abdomen her father accidentally discovered a swelling at a time when the child was believed to be quite well. No deviation from health and not a symptom of any kind had been observed. Once attention had been drawn to the swelling it was closely watched, and it soon became evident that a rapid increase was taking place. When brought under my notice the right half of the abdomen was occupied by a smooth firm mass, equal in size to a foetal head at birth, which moved visibly during respiration, and admitted of a considerable amount of lateral displacement. (I may remark parenthetically that unusual mobility due to or at least attended with an elongated pedicle was a marked feature in both cases.) In accordance with my practice at that time—a practice which I have long since abandoned as an aid to the diagnosis of any abdominal tumour—an aspirator needle was introduced, with the result that the withdrawal of a minute quantity of blood only determined the solid character of the growth. It was then decided to remove it, and the operation was performed at the patient's home. Owing to the entire absence of symptoms, the extreme mobility of the mass, and our inability to attach it to any organ, no diagnosis was arrived at. An incision was made through the linea alba in mid-abdomen, and the tumour, with cæcum and ascending colon, pushed across to the left and the vertebral column exposed. On inspection it was seen to consist of a growth springing from the kidney, and tethered by a broad pedicle, containing the renal vessels and the ureter, to the loin so loosely as to allow a free range of movement. Through an incision made in the external layer of the mesocolon the peritoneum was stripped, and the mass was delivered with more readiness than was expected, owing to the length of the pedicle. This was transfixed and tied with a double silk ligature. The kidney and tumour, weighing together 3 lbs. 2 ozs., were detached by means of scissors. The peritoneal incision was sutured, and the cavity drained by a rubber tube passed through the loin. The operation lasted an hour and a quarter. Five hours after its completion the temperature was found to be 101°, and the pulse was of good volume. The child was cheerful and chatted freely with her nurses. Two hours later—seven hours, that is, after the operation—the patient died with absolute suddenness. A subsequent examination of the growth—there was no *post-mortem* examination—threw some light on the cause of death, seeing that in the portion of the pedicle removed it was found that the enlarged renal vein abruptly widened out so enormously where ligatured as to suggest that the vena cava had been dragged by the weight of the mass of disease so as to project well within the root of the kidney.

Fig. 1.—Diagram illustrating effects of large tumour of right kidney producing great dilatation of renal vein and lateral displacement of vena cava.

In removing the kidney for malignant disease the surgeon, naturally anxious to avoid leaving a portion of the disease behind, secures the vessels at as great a distance as possible from the kidney. In avoiding this danger it is well to bear in mind another, that of including within the grip of the ligature a portion of the wall of the vena cava, and so incurring the risk of the formation of a thrombus, which at any moment may be washed into the right heart and give rise to sudden death.

The second case was that of a child 2 years old, admitted into the Leeds Infirmary in October, 1888. The right kidney was the seat of a cystic sarcoma, forming a large tumour, which filled the right half of the abdomen, and extended beyond the mid-line. This, as in the former case, admitted of a considerable range of lateral movement; but, unlike it, was not visibly affected by respiration. It was removed by the abdominal route, the incision being made to follow the course of the outer right linea

semilunaris. After incising the peritoneal covering and stripping the mass from its surroundings, it was found, as in the former case, that owing to the length of its pedicle it could readily be withdrawn from the abdominal cavity; and on closely examining the pedicle there was no difficulty in demonstrating the vena cava as one of its constituents; it occupied, indeed, so much of the mesonephron as to necessitate special care in the selection of the spot at which to place the ligature. The visceral peritoneum was closed by a continuous suture except at its lower end, where it was attached to the inferior extremity of the abdominal wound for drainage purposes. The patient recovered, and was sent home in December; but in the February following the attendant doctor wrote to say that the child died on the 7th of that month.

It will thus be seen that of the 11 cases of nephrectomy for tumour in young children 9 were operated on by the lumbar method, and two only by the abdominal. In deciding which of the two methods to adopt I have been guided chiefly by the size of the tumour, and in some measure by its mobility. Hitherto there has been, rightly or wrongly, a general consensus of opinion in favour of the lumbar route whenever applicable, and it is applicable to all or nearly all in which the tumour can be brought whole through the lumbar incision. In the two removed by the transperitoneal operation the mass was of relatively enormous size, and in both there was a degree of mobility sufficient to suggest an elongated and narrow pedicle. Of the 11, one, a pallid and wasted child 13 months old, died before the completion of the operation, and another lived only seven hours, death being sudden and probably due to cardiac thrombus arising from an injury to the vena cava. Nine recovered from the operation, but the longest survivor lived only 2 years and 5 months, whilst one was reported to have died at the end of 9 weeks. In how many deaths resulted from recurrence of the disease I have no means of knowing. Three times only had I the opportunity of seeing the child when nearing its end, and in each of these were undoubted evidences of recurrence. In two others the medical men in charge reported the presence of abdominal tumour.

My results are neither better nor worse than those reported by other surgeons. It is several years since I last undertook a nephrectomy in a young child, and unless future experience gives better ultimate results than I have hitherto met with, the want of confidence I already feel in recommending the operation in children suffering from malignant growths cannot but be emphasised.

In dealing with a mortal disease an immediate mortality of a little over 18 per cent. seems encouraging enough, but when it is borne in mind that the longest survivor of 11 died within two and a-half years the question forces itself upon our consideration whether it is worth while to incur the undoubted immediate risk of the operation and the anxiety to parents and friends for the possibility of so small a gain. Bear in mind, it is of young children I am speaking, in whom an addition of a few months, or of even a year or two of life is not comparable with a similar addition to the lives of adults. It is even doubtful if in these 11 children there was any actual increase in the aggregate length of life obtained. This raises a grave question, one which cannot, of course, be determined upon the experiences of a few. It is, indeed, too early yet to express an authoritative opinion upon the point, seeing that it is only within very recent years that nephrectomy has been undertaken by the general surgeon; and the collected data, although considerable, are insufficient for the purpose. In not one of my cases was an early diagnosis arrived at, and in all, consequently, the disease had made considerable advance before the operations were undertaken. The absence of prominent symptoms has doubtless militated against early removal in some, whilst in none, probably, has the surgeon deemed it right to open loin or abdomen until such time as he has been satisfied of the presence of a substantial growth. Considering with what little risk an intra-peritoneal inspection of the kidneys may be undertaken, if, on the earliest suspicion of a growth, an examination by inspection and palpation of the organs be made, it may be possible to detect the presence of sarcoma or other growth at a much earlier date than has hitherto been accomplished, and so, it may be assumed, to lessen the probabilities of return. Bearing in mind, however, that the only prominent signs of the disease in young children are the presence of a tumour in one or other loin, and the occurrence of hæmaturia; that whilst the latter is by no means constant, the former, even though it be of foetal origin, has usually attained a considerable degree of development before its existence is suspected, the probability of very early diagnosis seems somewhat remote; and

yet by early detection and prompt removal alone can we hope, to improve upon our hitherto unsatisfactory results.

In estimating the value of this operation, it is not sufficient for the statistician to tabulate his cases under the two heads, "Cured," "Died"; we must be informed as to the duration of life in those reported "Cured" or statistics will only mislead.

NEPHRECTOMY IN ADULTS.

Much more encouraging are the results obtained after nephrectomy in adults, partly because in the majority of cases the operation is performed for conditions other than those of malignancy, and in part it may be because of the lesser degree of malignancy usually met with in the renal tumours of the adult, and of their consequent diminished liability to diffusion and speedy return.

I have operated on 16 adults, of whom 6 had tumour, 3 calculous pyelitis, 4 tuberculous or other form of non-calculous pyelitis, 2 fistula following nephrolithotomy, and 1 uncontrollable hæmorrhage after nephrolithotomy.

Of the 6 tumour cases 2 recovered, 2 died within a few hours from shock, 1 died on the third day after operation with symptoms of intestinal obstruction which were not relieved by enterostomy, and 1 lingered nine days, gradually sinking from exhaustion.

The first of the two patients who recovered after nephrectomy for tumour was a man, aged 56, whose chief symptoms were frequent hæmaturia, a dull aching in the left loin, which was completely filled by a large growth, and increasing pallor with loss of strength. The substance was removed by the lumbar operation, and it was found to consist of an upper third of normal renal tissue and a lower two-thirds of new growth which was reported to be a malignant adenoma.

The second was a woman aged 56, in whom a diagnosis was arrived at only during the progress of the operation. She was very stout and her abdomen especially was fat and large. After her third confinement, nine months before she came under observation, she discovered a globular substance in her left abdomen, which, however, gave rise to no inconvenience. It increased in size, and in June, 1900, it was described as being round and of the size of an average cocoa-nut. It lay in the left iliac fossa, was firm, and it had a free range of movement. It could be made to lie on the lumbar vertebrae, could be pushed upwards into the loin, leaving the iliac fossa empty, and it could be brought downwards just within touch of the fingers in the vagina at the brim of the pelvis. No attachment to the uterus could be made out. The functions were in no way interfered with and the patient's general health was good. On opening the abdomen in the middle line and exposing the tumour it was seen to spring from the left kidney. Pushing the intestines to the right it occupied the whole of the space between the twelfth rib and the iliac fossa, and was composed of the upper half of the normal kidney resting upon a capsulated growth which included the pelvis and the rest of the kidney. The upper portion of the kidney, not directly involved in the growth, had a remarkably elongated appearance as if it had been stretched by the weight of the tumour, and by its means the range of movement was greatly increased. Its peritoneal covering having been incised and stripped off, the pedicle was secured and the whole removed. Drainage was effected through the loin and the peritoneal wound was closed by suture. The tumour was composed of a mass of cysts enclosed in a thick capsule, and contained no malignant element.

The 4 who died presented large tumours, and in all the transperitoneal method was the operation selected. Two males, aged respectively 53 and 61, and one female aged 34, were the subjects of disease in the left kidney, pronounced to be sarcoma. The fourth was a male, aged 56, with carcinoma of the right kidney and adrenal extensively adherent to the under surface of the liver.

Of the 10 adults in whom nephrectomy was performed for conditions other than that of tumour, 2 died and 8 recovered.

One of the fatal cases was that of a young man from the substance of whose kidney I had removed a calculus by an incision made directly over the stone, through the substance of the kidney tissues. Very free bleeding at the time of operation was temporarily arrested by pressure, and it was not until after several recurrences of the hæmorrhage during the next three days it was decided to remove the kidney. At the operation, the wound was believed to be in a septic condition, infected probably by the suppurating pelvis of the kidney. In spite of much care and pains taken to cleanse the wound, the patient died of septic peritonitis. The other fatal case was that of a delicate woman, aged 30, from whom I had a few months before removed four small calculi found loose in the pelvis of the kidney, which was also largely distended with pus. It had become evident that the patient must sink. The lumbar nephrotomy wound continued to discharge pus mixed with some urine in large and undiminished quantity, the condition of the patient was deteriorating, and the temperature pointed to a general septicæmia. In the hope of being able to arrest this down grade the kidney was removed through the loin. The patient only survived the operation fifty-eight hours, and during that time no more than 8 ounces of urine were secreted.

Of the 8 who recovered, 3 were the subjects of calculous pyelitis, and had previously undergone the operation of nephrolithotomy; 4 were for tuberculous or other form of non-calculous pyelitis, and, like the former, had previously

undergone nephrotomy; and 1 was for urinary fistula following nephrolithotomy. In each the lumbar operation was selected.

It will thus be seen that of the 5 transperitoneal operations, 4 died, whilst of the 11 lumbar nephrectomies 2 died, showing a difference as between 80 and 18 per cent.; whilst if the whole 16 be classed together, with 6 deaths, the mortality is 37½ per cent. This places the transperitoneal operation in a very unfavourable light. But in estimating the relative dangers of the two operations, the nature and extent of the disease as well as the character of the operation itself must be taken into account. The lumbar route being inapplicable to the largest tumours—and the larger the tumour, other things being equal, the more dangerous its removal—it follows that some of the least promising are transferred to and made to swell the mortality of the abdominal operation. So again, the age of the patient must influence the death-rate. Of the 4 who died, 1 was over 60, and 2 between 50 and 60.

A mortality of 37½ per cent. cannot be accepted as at all satisfactory, and increased experience leading, as doubtless it will, to improvements in the technique of the operation and the avoidance of many pitfalls, may be confidently reckoned upon for the securing of better results. How far, for instance, with improved methods of combating or averting shock we may be able to lessen the mortality, the future will decide. At the time when the 4 transperitoneal operations for tumour were undertaken we were not in the habit of injecting strychnine hypodermically, or of introducing saline solutions within the veins, two powerful agents without which no surgeon would at the present day consider himself sufficiently armed when undertaking operations of such magnitude or involving such prolonged anaesthesia. The 2 patients, at least, who died within a few hours of the operation, I cannot but think would have had a better chance of recovery had we been able to make use of the means for averting shock with which we are now familiar.

In weighing the advantages and disadvantages of the two operations with a view to selection in a given case, it must be noted that in the anterior method the peritoneum is twice incised, whilst in the posterior that membrane is not necessarily wounded at all. This is a matter of very considerable importance, more especially if the organ to be removed is in a septic condition, as is the case in all suppurative diseases. Speaking generally, the lumbar route is to be selected in preference to the anterior whenever the kidney is known to be undergoing septic inflammation, as also in those cases of neoplasm which present no such difficulties as are due to mobility or to extreme size; for whilst the danger of soiling the peritoneum during the extraction of a septic organ through an anterior opening is a very real one, and would lead to a preference for the posterior route, the difficulty of removing a very large growth through the limited space between the costal margin and the iliac crest, or of enucleating a kidney having a free range of movement within the abdomen, would suggest the desirability of attacking it from the front. The transperitoneal method possesses further advantages, such as enabling the operator to examine the opposite kidney as well as the other abdominal organs, in any of which might be found secondary growths or other conditions sufficient to negative the completion of the operation; and, again, the readiness with which the renal vessels may be secured in such manner as to render the operation a comparatively bloodless one.

On reviewing my own work, apart altogether from results—for, indeed, the number of cases is not sufficiently large for statistical purposes—I incline to the opinion that the lumbar operation will continue to be preferred for those cases in which sepsis is known, or is assumed, to exist, and for those neoplasms in which the growth is of recent origin and of small or moderate size, whilst the larger renal tumours will be attacked from the front with more prospect of success in proportion to our increased knowledge of and attention to details in the operation itself, and to our ability to avert death from shock.

I have said that nephrectomy in the adult gives more encouraging results than is obtained in children. This declaration must be qualified in that it applies not to the immediate but only to the ultimate result. It will have been seen that of the 11 children, 9 recovered from the immediate

effects of the operation, showing a mortality of 18 per cent., whilst of the 16 adults 6 died whilst under treatment, giving a mortality of 37½ per cent.; but on inquiring into the future history of these 10 adults, whose operations were successfully accomplished, we find a much more favourable record than in the cases of the children, the longest survivor of whom, you will remember, died within two and a half years. Of the 10 adults who recovered one, aged 56, the subject of "malignant adenoma" attended with persistent and profuse hæmorrhage, whose kidney was removed by the lumbar method in 1888, survived nine years without any sign of return of the disease, the cause of death being certified "cardiac dropsy." This man during several years after the operation continued to work as a compositor in a newspaper office, and on several occasions he assured me that his health was in no way impaired.

Another of the successful series was that of the woman, aged, 36, whose left kidney with tumour attached was removed by the anterior operation in June, 1900. The growth in her case was reported as one of cystic degeneration devoid of malignant elements, and she is now in good health. Of the remaining 8 successful nephrectomies—all of which, undertaken for conditions other than that of neoplasm, were performed by the lumbar method—3 are known to be still alive and well, and their respective operations bear the dates 1883, 1890, and 1891. One was reported to be in good health 15 months after the operation, 1 migrated to Australia "about 3 years after his kidney was removed," and of 3 I have failed to find any trace. Such results as these, if we take into consideration the hopeless condition in which most of the patients were placed at the time their operations were undertaken, imperfect though they are, cannot fail to encourage us in persevering with a radical treatment which, if essentially fraught with risk, may yet admit of such improvements as will lead to greater and more certain success in the future.

NEPHROLITHOTOMY.

In furtherance of my intention to place before you some examples taken from my own personal experience in renal surgery, and altogether repudiating any pretensions to originality or claim to address you *ex cathedra*, I will now pass on to a brief consideration of nephrolithotomy—an operation which I confess not to have held in the highest estimation until within the last five or six years, owing, as I now realise, to the non-recognition of essential anatomical considerations.

In October, 1882, I attempted to sound a kidney for stone by means of a long fine needle passed through the loin, and whilst the instrument was being manipulated it snapped, leaving five inches buried in the tissues. This *contretemps* compelled me to incise the loin, and, owing to the difficulty I experienced in finding the needle—which, however, was eventually recovered—the kidney was exposed, and I was thus enabled to make a more thorough exploration by means of the needle passed in many directions and to varying depths. The result was negative as regards the discovery of a calculus, but from that time the renal pain disappeared, and thus a cure, which at that date and for many years after seemed inexplicable, was accidentally brought about. Not until 1886 did I succeed in locating and removing a calculus, although I had in the meantime made unsuccessful attempts on 4 patients to discover a suspected calculus by means of manipulation and needle-puncture of the kidney exposed at the bottom of a lumbar incision. Fortunately no harm was done to any of the four. The patient from the pelvis of whose kidney I succeeded for the first time in removing a calculus had a narrow escape from death by hæmorrhage, owing doubtless to the position and direction of the incision, which was made on the anterior aspect of the kidney immediately beyond the pelvis, parallel with the long axis. The stone was branched, weighed a little over two drachms, and was so imbedded in the kidney structure as to cause some amount of tearing in its extraction. Hæmorrhage, very free at the time from the wound, was eventually arrested by sponge pressure, and as on removal of the sponge a few hours later the hæmorrhage had apparently ceased, whilst there was no indication of an escape of urine, the external wound was closed. Next day, as he had not voided urine, and the bladder was found to be moderately distended, a catheter was passed

and some deeply-stained urine drawn off without materially lessening the distension. Upon this a suction syringe was improvised, and by its means a large amount of coagulated blood was extracted. As upon examination the lumbar wound was found to be in a wholly satisfactory state, further interference seemed uncalled for. During several days the pumping operation had to be repeated, but eventually the bleeding ceased, and his recovery progressed slowly to its completion. In 1888 there occurred the unfortunate case I have previously mentioned, in which after an incision similar to the one just described, repeated external hæmorrhage extending over several days decided me to remove the kidney, with the result that the patient died from septic infection. It thus became manifest that hæmorrhage constituted a formidable danger in the removal of calculi impacted in the kidney substance.

Amongst my early cases again were two in which stones were readily discovered by palpating the pelvis, and were almost as readily removed through direct incisions in the pelvic wall without implicating the kidney tissue proper. In one of the two I made an attempt to suture the wound, but in both the whole of the urine continued to flow through the drainage tube and permanent fistulæ became established. Relief from the intolerable nuisance produced by the leakage was at length obtained by removal of the organ.

For a time my hope for the future of nephrolithotomy fell to a low ebb, and I almost despaired of seeing it established as a useful operation. Interest, however, was revived in May, 1888, by a successful issue in the following case:

A farmer, aged 52, came under my care in the infirmary complaining of loss of strength, and of his urine being "milky." He was stout and sawn faced, of aged appearance and flabby limbed. His complaints were exceedingly few. His urine contained one-fourth pus, and the left half of his abdomen was occupied by a smooth definitely outlined elastic tumour. He had never known pain, had worked up to the time of his admission, and had only noticed the change in his urine for a few weeks. He was not an observant man, and his previous history was almost a complete blank. On a diagnosis of pyonephrosis I cut down upon the left kidney, and on incising it twenty-six ounces of pus were collected. A digital exploration of the thin walled sac into which the kidney had been converted revealed the presence of this unusually large stone, which after extraction by means of large lithotomy forceps was found to weigh eleven ounces, one hundred sixty grains. It was firmly adherent and had to be peeled off, so intimate was its connection with the pelvic wall. The kidney was a mere shell, and had ceased to perform its function, for at no time was there any discharge of the urine from the drained wound. During the first few weeks pus flowed freely, though in diminishing quantity, and in little more than four months the wound was closed. About five years after the operation, having meanwhile enjoyed good health, he died with symptoms, so I was informed, of intestinal obstruction.

Fig. 2.—Renal calculus (one-half size) weighing 11 ozs. 160 grs.

In view of the enormous size of the stone and of the very extensive character of the disease in this case, the entire absence of pain from commencement to end forms a very remarkable feature, which serves, however, to emphasise the fact, verified again and again in my own practice, that the amount of suffering in nephrolithiasis bears for the most part an inverse relation to the size of the stone. A small mobile calculus lying loose in the pelvis, partially blocking

now and again the orifice of the ureter, gives rise to greater and more frequent pain than does a larger one fixed in a calyx or embedded in the kidney substance. This, by far the largest specimen I have myself removed, was unattended with pain at any period of its formation or growth, whereas the patient who within my recollection suffered most and most frequently, requiring daily administration of morphine for a period of three to four months, eventually passed a small lithic acid calculus *per urethram* to her complete and permanent relief. It is worth mentioning in this connection that the stone was passed during the night following my first examination of the patient, which included a free manipulation of the loin, and resulted in arrangements being made for a nephrolithotomy on the following morning—arrangements which were of course indefinitely postponed. How far it may be claimed that the stone received a determining impulse on its outward passage from the hands of the manipulator I am unable to assert, but that such an explanation is not wholly chimerical receives some support from the following two cases.

I was asked by the directors of a railway company to examine on their behalf a man who was seeking compensation for damages received in a collision. The injuries were severe and indicated considerable violence. Amongst the details of the accident it was stated that he was thrown upon the floor of the compartment, where he received several blows upon his back from other passengers falling in a confused heap upon him. After having been conveyed home his sufferings were so severe that, pending the arrival of a medical man, his wife had him placed in a hot bath. Whilst lying there micturition became imperative and frequent, the urine being decidedly blood-stained, and at length he emitted a lithic calculus of the size and shape of a barleycorn. The other case was that of a young man suffering from well-marked renal colic, in whose kidney I failed to detect a stone by careful manipulation and needle puncture. The search was abandoned and the wound closed. Early next day he was found to be suffering from retention of urine, due to the impaction of a calculus in the membranous urethra, plainly felt in the perineum. It was removed through a median incision, and the retention was speedily relieved. In the one case the escape of the calculus so shortly after the patient had been violently shaken and severely pounded amply suggests cause and effect, whilst in the other there is little room for doubt that the search by palpation of the kidney and its pelvis directly resulted in the escape of the stone and its forced entrance into the ureter. The possibility, therefore, of a stone becoming detached and released should not be lost sight of lest an additional danger be introduced, necessitating a further operation for the recovery of the stone, the presence of which in the ureter or elsewhere has become a matter of certainty.

To return, after this diversion, to the early misgivings I entertained in regard to the future of the operation of nephrolithotomy—misgivings which were in no degree lessened by the satisfactory result following the removal of this exceptionally large stone. Up to the year 1896 I had operated on 19 patients whose symptoms had led me to diagnose stone in the kidney, exclusive of 2 in whom unsuspected stones were met with—that, namely, in whose attenuated kidney the large calculus was found, and another who presented similar symptoms of pyonephrosis only, and in the pelvis of whose kidney, besides a quantity of pus, two calculi were discovered. In none of the 19 operations was the kidney withdrawn from its normal situation; it had not, indeed, occurred to me that such a procedure was feasible. The plan adopted had hitherto been to expose the kidney by incision through the loin, to strip it anteriorly and posteriorly of its investing fat, to palpate the whole organ, including its pelvis and the upper portion of the ureter; to needle puncture in every direction those cases in which simple palpation gave negative results; and, finally, to cut directly upon the stone wherever one was discovered, whether in the substance of the kidney, in the pelvis, or in the upper reaches of the ureter. In 5 no stone was then or thereafter found; in 1 a displaced stone was subsequently extracted through an incision made in the perineal urethra; in 2 severe hæmorrhage—leading to a fatal nephrectomy in 1—followed the incision made directly over the stone through the kidney substance; in 2 nephrectomy was resorted

to for relief from permanent urinary fistula; and in 9 recovery was uncomplicated and complete.

About the year 1896, in a conversation with him respecting a patient suffering from advanced tuberculous disease of both kidneys, Mr. Henry Morris stated that he was in the habit of withdrawing the kidney from its bed so as fully to expose it outside the lumbar wound, of splitting the organ into two symmetrical halves by an incision carried from its convex border through to the pelvis, with the object of curetting and otherwise treating masses of tubercle and of returning the kidney to its natural position after having passed three or four catgut sutures deeply through the substance of the organ, which he tied with just the amount of force needed to arrest the bleeding. Since that time I have adopted a similar procedure in the removal of stones from the kidney in five cases with most satisfactory results. In none has there been any difficulty in controlling the hæmorrhage, in all the wounds healed directly and there has been no urinary fistula to complicate the results. Should the future confirm these experiences nephrolithotomy will have been deprived of two of its chief dangers, those, namely, of severe hæmorrhage at the time of operation and afterwards, and of that most troublesome and distressing condition, a leakage of urine through the loin; in addition to which there are the manifest advantages during the operation of a complete inspection of the kidney and its pelvis, and the consequent diminished likelihood of overlooking a stone, together with a greatly increased facility of examining the ureter from end to end by means of a probe, in case of suspicion that a stone has escaped during the earlier steps of the operation.

To account for the abundant hæmorrhage attendant on an incision through the anterior or posterior surfaces of the kidney as compared with one made through its centre, splitting it into two symmetrical halves, it is needful only to bear in mind the arrangement and mode of distribution of the renal vessels when once they have entered the organ, and the very liberal supply of blood they receive. The radiating interpyramidal arteries and veins intercommunicating by arches across the pyramidal bases, from which numerous vessels carry the blood to and from the cortex, constitute a plexus which, if anywhere cut across, pours out blood as freely almost as if the renal vessels themselves were wounded. The further we proceed, on the other hand, from the primary branches of the renal artery into the substance and towards the periphery of the cortex, the smaller the vessels become and the more easily is the bleeding controlled, and thus it follows that an incision carried from the outer border of the kidney straight through its centre to the pelvis, involving fewer of the primary branches, is attended with less hæmorrhage, and that of a kind more easily arrested, than if the incision is made transversely across the organ. So also as regards the formation of urinary fistula, incisions made through the comparatively thin walls of the ureter or pelvis, more especially if these be diseased owing to the presence of a stone, are less likely to result in primary union than are the extensive, even, and vascular surfaces of the two halves of the kidney when accurately approximated by deeply-placed sutures. It has not, moreover, in every case been necessary to split the entire kidney, but I have not hesitated to do this where such a course has been called for, and in all the incision has been commenced at the convex border, and carried down to the pelvis, or so far as has been needed to expose the stone.

In withdrawing the kidney, so as to inspect it outside the loin, the danger of tearing the pelvis, or even of detaching the ureter must not be lost sight of. The former accident actually occurred in my hands, and although by carefully suturing the the wound a fistula was avoided, the risk of establishing a permanent leakage is greater when the pelvis is torn than in the case of an incision made for the purpose of extraction, and we have seen that in two cases—in neither of which, it is true, was any attempt made to suture the edges of the incision—this untoward result was brought about. The pelvis which has been long occupied by a stone, and has thereby become attenuated, and more especially if the seat of a pyonephrosis, will be likely to give way more readily to the stretching than one in a state of health, and the wound in it will, moreover, be less likely to close, no matter how carefully sutured. Bearing these possibilities in mind, the withdrawal and expo-

sure of the kidney, followed by the operation of splitting muffin like, is calculated, I feel sure, not only to facilitate the removal of stones from the interior of the kidney, but to render the operation safer and more effective.

VESICAL CALCULUS.

In no single branch of surgery have more important changes and improvements been made during recent years than in the method of dealing with stone in the bladder. Within the recollection of every middle-aged surgeon a complete revolution indeed has been witnessed, and it may be considered not altogether inappropriate if, after having indicated the method of dealing with calculus in the kidney which in my hands has given the best results, I conclude by making a few observations upon the present and former procedures made use of for the removal of stones from the bladder.

But a little while ago the choice lay between perineal lithotomy and lithotripsy as practised by Civiale. It is doubtful if at the present day half-a-dozen hospital surgeons could be found in this country who are in the habit of performing either operation. During several generations lateral lithotomy stood at the head of the list of the surgeon's performances, and few of the elders amongst us can fail to feel a pang of regret on looking back to the days when students and other onlookers anxiously watched whilst the surgeon with more or less precision and rapidity relieved his patient of the stone. Lateral lithotomy was the accepted test of the surgeon's claims to pre-eminence as an operator, and few I imagine ever experienced an entire absence of nervousness when about to undertake its performance. The oldest, most experienced, and most successful lithotomist of my acquaintance published a confession that he invariably suffered from a feeling of nervousness when about to undertake the removal of a stone, and as on no other occasion was he the subject of fears or qualms, he termed it his lithotomy feeling. There was good excuse for this. So many pitfalls surround the operation as to make it a matter of relief when safely completed; so many excellent operators have failed once at least in bringing about a successful issue. The traditions of almost every large hospital contain at least one example of failure. I have myself seen one of the ablest surgeons of his day remove a stone of considerable size by this operation from an adult in whom, *post mortem*, it was found that neither urethra, nor prostate, nor rectum had been wounded—a result which elicited from an enthusiastic admirer the remark that the operator was probably the only surgeon in England who was capable of performing such a feat.

Notwithstanding the difficulties and dangers attendant upon the operation itself, the occasional occurrence of unpleasant sequelæ, and the mortality, amounting in the best hands to 1 in 8, and in spite of the many attempts at modification—bilateral incision, median incision, the use of curved, of straight, or of rectangular staff—lateral lithotomy maintained its position at the head of cutting operations for stone until within twenty years of the present time.

Lithotripsy, in the hands of a few skilful manipulators, from the time of its introduction about the middle of the first half of last century, gradually increased in favour as the instruments for crushing and evacuation were improved, but it cannot be said at any time to have rivalled the cutting operation, being for the most part reserved for those comparatively few favourable cases in which the stone was small and the organs generally healthy. It was not until the gradual development of lithotripsy into the more complete litholapaxy at the hands of Bigelow nearly a quarter of a century ago, and the almost simultaneous revival of suprapubic lithotomy, that the doom of lithotripsy and of lateral lithotomy was sealed.

The manifest advantages and the vastly-increased safety secured by removing at a single sitting the crushed fragments of a stone, whether small or of a considerable size, the precision and certainty with which the bladder was opened, digitally explored, and even inspected through an anterior incision, was not long in obtaining for the two new operations an established position, and at the present time I shall not be far wrong in saying that with very few exceptions litholapaxy or suprapubic lithotomy is chosen in every case of vesical calculus, whether in male or female, in child or adult; and litholapaxy claims first consideration. There must be

some good reason for deciding upon lithotomy in preference to litholapaxy now that the latter operation in skilled hands and in well-selected cases is attended with so little danger and incurs so brief a period of disability. The mortality no doubt after either method of extracting a stone depends less upon the nature of the operation itself than upon the presence or absence of complications. Apart from the general health and strength and age of the patient, the size and composition of the stone, the capacity of the urethra, the presence or absence of prostatic enlargement and of inflammatory disease in bladder or kidneys must materially influence the results. In a perfectly uncomplicated case, one in which a successful issue may be expected from either operation, litholapaxy would naturally be chosen as involving less mutilation and a less prolonged period of convalescence. Some complications there are which, apart from other considerations, entirely negative the less serious procedure, such, for instance, is the presence of an advanced stricture in any part of the urethra beyond the meatus, with which I may class an abnormally narrow urethra, one which admits only an instrument altogether disproportionate to the size of the stone. I have met with one instance in a generally ill-developed man of middle age whose urethra, though showing no signs of disease past or present, would not, even after slitting the meatus, admit the smallest sized lithotrite I possessed. The presence of advanced prostatic disease may be, I think, rightly held to exclude litholapaxy, not so much on account of the obstruction it presents to the free use of the lithotrite and evacuator, or on account of its liability to injury, but chiefly because, by adopting the suprapubic operation, an opportunity is afforded for dealing radically with the prostate as well as for removing the stone.

There are calculi too large to be crushed, and a few—I have met with two such—so hard as to resist the most strenuous efforts to break them. The presence of cystitis, if of long standing, must be held—certainly if the stone be of more than moderate size—to contraindicate the crushing of the stone, seeing that a prolonged operation involving more or less injury to the bladder would incur the risk of converting a mild into an acute and relatively dangerous state of inflammation; and, finally, in the case of an encysted calculus, litholapaxy may be considered to be wholly inapplicable, not only because of the difficulty, for the most part insuperable, of releasing the stone from its pouch and of effectually breaking it into fragments which shall be accessible to the aspirator, but also because of the intense cystitis which, so far as my observation extends, is a marked feature in cases of encysted calculus. In these the superiority of suprapubic lithotomy over any other form of operation is abundantly manifest, and, seeing that I have met with 3 such cases, whilst the total number successfully operated on is very small, I desire here to place them on record:

The first was that of a young man of very poor physique, in whom the sound struck a stone the moment it entered the bladder. His symptoms had been of long duration and markedly pronounced, so that I concluded the stone was large. A lithotrite passed into the bladder grazed the under surface of the stone, but all attempts to seize it proved futile. With the left forefinger in the rectum and my right hand placed on the lower abdomen I could distinctly feel the projecting calculus fixed beneath the pubic arch. Here was a combination of circumstances which might be said to invite an attack from above, and accordingly I proceeded at once to perform my first suprapubic lithotomy. Sir Henry Thompson had but a few months before described the operation in detail, and I followed in the main the directions he had given. On inserting my finger through the suprapubic opening it immediately impinged upon a stone slightly projecting on the left of the urethra. A further examination revealed the fact that the calculus was imbedded to about three-fourths its extent in a sacculus occupying a space below the pubic arch, and between it and the prostatic urethra. From this hollow it was shelled out by means of a scoop and the finger, and then readily removed.

I do not believe that by any other operation the stone could have been extracted. No finger could have done more than touch the exposed end if introduced through the perineum, nor could any lithotrite have been made to grasp the stone between its blades. Of further complications there were none and his recovery was uninterrupted.

The second which came under observation at the infirmary in 1888 was in a man 73 years of age. His urethra, owing to what was supposed to be an enormously enlarged prostate, did not readily admit a sound, and on that account, as also because of his advanced age, the severity of his symptoms, the presence of a considerable amount of muco-pus in the urine,

and the fact that his bladder retained from six to eight ounces of residual urine, the suprapubic operation was decided upon. A globular oxalate calculus weighing thirteen drachms was removed from a pouch at the base of the bladder, situated on the right of the middle line, which con-

Fig. 3.—Diagram of sagittal section to left of middle line through pelvis showing encysted calculus in bladder beneath pubic arch and to the left side, removed by suprapubic lithotomy from a young man. Weight of calculus, 3vi.

cealed all but the slightly projecting surface of the stone. This it was which had led to the supposition of his prostate being largely hypertrophied. As a matter of fact the prostate was enlarged, but the hypertrophy was confined to the middle lobe, which, projecting upwards in such manner as to obstruct the urethral entrance, was removed. Recovery followed.

Fig. 4.—Diagram of sagittal section to right of middle line through pelvis, showing encysted calculus on right of base of bladder and projecting middle lobe of prostate, in a man, aged 73 years; both removed by suprapubic lithotomy. Weight of calculus 3xiiij.

[The third case came under my care in 1899.

The patient, aged 60, after having long suffered from painful micturition, had the misfortune whilst following his occupation to crush his perineum by falling from a height astride a beam. Urethral laceration, attended with copious hæmorrhage, was followed by a troublesome stricture which added considerably to his urinary difficulties and suffering. Prior to the accident he had undergone treatment for cystitis.

When brought under my observation, some months after his accident his condition was most unpromising. His urine, passed *guttatim*, was purulent and offensive. He was sallow, thin, and devoid of appetite. As a No. 3 gum elastic catheter had been occasionally passed with temporary relief, and without exciting any febrile disturbance I began gently to dilate the stricture by means of Lister's sounds, beginning with 2 to 5. Before I had proceeded far the sound struck a stone, and thus I found myself in face of an added difficulty. My first impulse was to perform external urethrotomy and to extract the stone through the median incision, but as for this I was not prepared proceedings in that direction were arrested. Further dilatation enabled me to make a closer and more detailed examination. First I satisfied myself of the facility with which a free dilatation of the urethra could be accomplished; then I was able to make out by means of the sound that the stone was of considerable size, that it lay on the left at the base of the bladder, that it was fixed in its position and, lastly, by means of the finger in the rectum that it projected backwards beyond the prostate towards the sacrum, and was probably situated in a pouch. On a subsequent day I opened the bladder above the pubes and removed a calculus weighing ten drachms from a pouch, situated as I have just described, which enclosed almost the entire stone, leaving only a segment of its surface exposed. His future course and recovery were uneventful.

The success attendant upon these cases thus briefly narrated, together with the facility with which the stones, though deeply embedded in the bladder wall, were extracted weigh much with me in estimating the relative value of the several modes of performing lithotomy. In the first case, as I have already remarked, by no other route could the stone have been removed; in the other two the difficulties of their extraction through the perineum must have been well nigh insurmountable, whilst in none of the three would it have been possible to grasp the stone within the blades of a lithotrite.

Fig. 5.—Diagram of sagittal section to left of middle line through pelvis, showing encysted calculus on left of base of bladder removed from a man, aged 60 years, by suprapubic lithotomy. Weight of calculus 3x.

Up to the year 1883 perineal lithotomy, lithotripsy, or a combination of the two in the case of a very large stone, was adopted in my practice in every case, lithotripsy being reserved for the smallest stones in adults whose general conditions were favourable, median perineal lithotomy was selected for small stones in children, and lateral, or very rarely bilateral, lithotomy for medium-sized and large stones at all ages. From 1883 to 1890 was a period of transition. Litholapaxy was rapidly superseding lithotripsy, and suprapubic lithotomy was with almost general consent replacing the perineal operation. Since 1890 my practice has been without exception limited to the two operations litholapaxy and suprapubic lithotomy; to the former, whenever I have found it reasonably practicable, irrespective of the age of the patient, and to a great extent of the size of the stone; to the latter, whenever existing conditions were such as definitely to forbid the use of the lithotrite and aspirator, and in a few instances in which the weight of evidence seemed to favour the shorter, if on the whole

severer, measure. With these two operations and their results I feel much reason to be satisfied; and although finality is no more applicable to the treatment of stone in the bladder than to other surgical problems, I feel little doubt that in the near future any improvement in our means of dealing with calculous formations must be directed to the perfecting of our present methods of procedure, rather than to the discovery of new operations or the revision and revival of the old. Perineal lithotomy, associated though it has been with many generations of the greatest surgeons in the world, up to a few years ago universally held to be the most important operation in surgery, is now all but relegated to the past, lingering only, I believe, in the hands of the few, and is doomed almost certainly to become ere long a subject for the historian alone.

The three subjects upon which I have so cursorily discoursed are not the least important amongst the many which have exercised, and still are exercising, the minds of the present generation of surgeons. In each there is much need for increased experience and for wider observation; and if my small contribution be considered at all worthy of the acceptance of this audience, I shall feel myself more than rewarded.

An Address

ON

THE SANATORIUM TREATMENT OF PULMONARY TUBERCULOSIS.

Introductory to the Discussion of the Subject at the British Congress of Tuberculosis.

By R. W. PHILIP, M.A., M.D., F.R.C.P. EDIN.,
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In this address I shall endeavour to refrain from the expression of merely academic opinion regarding the effect of what has been termed the sanatorium treatment of pulmonary tuberculosis.

I prefer on the present occasion to base my statement on personal observations which have been continued for some ten years. These have concerned a large series of patients. The list includes more particularly some 700 patients treated on more formal sanatorium *regime* under my eye at the Victoria Hospital for Consumption, and at Woodburn Sanatorium, Edinburgh. It includes also patients who have been subjected, on my advice, to similar treatment at other sanatoria or privately. While I am familiar with the methods of, and have visited, many sanatoria both in the United Kingdom and abroad, it seems desirable to restrict the present survey to "facts observed by myself."

THE SYSTEM.

It may be convenient if I outline in a word or two the leading features of the system as I conceive it.

In the first place, while the principles of the system are physiological and correspondingly definite, there can be no hard-and-fast rule applicable to every case. The detailed application varies in different instances. Herein lies one of the dangers both to the system and to patients who happen to be committed for treatment into the hands of persons, who regard the matter as largely rule of thumb, or swear blindly by the precepts of one master. Each case requires consideration *per se*. At the same time certain broad lines are followed. These may be considered under the following heads:

1. Open Air.

There is no doubt, notwithstanding much that has been written in qualification of the statement, that hyperaeration (as conventionally we are wont to conceive it) is the major agent in the treatment. It is the one essential—the *conditio sine qua non*. While difference of opinion as to dietary, as to the relative amount of rest or activity, may be admitted in different cases, the uninterrupted exposure of the patient to the influence of fresh air is applicable in every instance. In my experience there cannot be too much of this.

I remember in the early days feeling a certain timidity as to

the length and degree of exposure of the patient. We were careful to attain a fairly constant temperature in dwelling and bed rooms occupied by patients. It used to be an instruction to our nurses that the temperature should be regulated by the thermometer placed in each room. Especially were more delicate patients thus carefully handled. Experience has modified this greatly. I allow the freest access of fresh air to the patient day and night, at all seasons, provided he is sufficiently clad. I am not careful as to the temperature of the surrounding air, whether in or out of doors. Indeed, there seems a disadvantage in endeavouring to combine free exposure of the patient out of doors with his occupancy of rooms whose temperature is maintained constant, or, still worse, which may become over-heated. It is more logical, and experimentally more successful, to subject the patient indoors to approximately the same conditions as out-of-doors. Assuredly let him be comfortably warm by means of clothing, and, if necessary, by hot bottles; but let us be sparing of artificial heating of the atmosphere.

It is an interesting commentary on this statement to add that the results during the series of years I have mentioned have proved themselves in many respects more satisfactory in winter than in summer. Even with the most delicate patient I have on no single occasion observed a bad result follow the most complete exposure to such influence. Contrariwise, in proportion as the patient is more freely exposed the satisfactory result is attained more quickly. During the present spring, for example, I have allowed a considerable number of patients not only to be out all day but to sleep outside all night, merely under cover of a three feet deep shelter, which is completely open to the front. Some of these patients literally ran ahead as compared with other patients sleeping indoors and in the entire group the results were uniformly satisfactory. Subject to reasonable care in respect of clothing there cannot, in my experience, be too free exposure to the open air.

2. Rest and Release from Disturbing Conditions.

It is a mistake to speak as if the system of rest were one, and the system of exercise for such patients were another thing. Neither the *Liegehalle* or hill climbing is applicable in every case. These should not be pitted against each other as if they constituted opposing modes of treatment.

For almost all patients rest is the immediate indication when treatment is commenced. This must be maintained for most patients, as part treatment at least, for a long time. The determinant of the necessary degree of rest is especially the state of the pulse and the temperature. It is desirable that the patient should rest chiefly if the temperature oscillate from day to day above 100.5° F., or if the pulse-rate be maintained above 90 per minute.

The negation of rest means in such cases greater irregularity of temperature and increase of pulse-rate with other evidence of circulatory prejudice. It is remarkable how certainly an apparently slight error in this matter registers itself in elevation of temperature and circulatory disturbance. Even the visits of friends, the receipt of letters, or similar incidents may exercise a definitely harmful influence.

3. Exercise.

As improvement proceeds, as evidenced by the general condition, and more particularly by the pulse and temperature, the necessity for complete rest is removed. The patient is allowed to take short turns, measured by minutes at first, and then of greater extent, once or twice in the day. Such exercise is begun on the level, and gradually allowed on an incline, until even hill climbing becomes possible. At all times the rate of progression should be slow, and care be taken that the respiratory movements are free and full.

As the necessity for rest lessens, the intervals of activity are correspondingly lengthened. The effect of activity should be gauged by careful record of pulse and temperature. At this stage, too, simple respiratory exercises often prove of service. Many patients have much to learn regarding the physiology of respiration.

4. Dietary.

Alimentary disturbances form leading features of the disease. These are corrected by a carefully studied dietary, of which the patient must be induced to take a sufficient quan-