Observations

ON

ANALGESIA AND ANAESTHESIA IN
CHILDBIRTH.*

BY

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A CONSIDERABLE amount of discussion has been taking place in Britain as to the necessity for the provision of treatment for pain in so-called normal labour. Among medical practitioners the subject is a somewhat controversial one. It is obvious that one of the first principles of treatment in medicine is that when pain is present it should be relieved as soon as possible. Some, however, maintain that the pain of childbirth is an exception, and that any effort towards its relief is against the will of God. Had Sir James Simpson been influenced by the ecclesiastical arguments of his day we might not have had the benefit of chloroform narcosis in obstetrics or in surgery. In obstetrical practice it should be an axiom that pain should be relieved in every case when it does not interfere with the safety of the mother or child.

Anaesthesia in cases of complicated labour is a necessity when operative measures are indicated. This is not a controversial subject. It is in cases where labour, although looked upon as normal, is accompanied by pain and suffering, that women now demand relief. How far with safety can we give freedom from pain? A painless labour can never be safe, but a very considerable modification of suffering is within the scope of treatment of every practitioner. In the past little attention has been paid to the subject, but now women refuse to submit to the sufferings borne by their mothers and grandmothers. Not only do they demand relief for themselves, but in London a large and influential group of members of the public is providing resident anaesthetists for various maternity institutions, in order that the patients should be given relief, and that students and nurses should be trained in the advantages of childbirth conducted by humane methods of treatment. The agony of child-bearing is almost worse than any other suffering, and there must be some reason why the average practitioner does so little for its relief. In the first place, so little is known as to the risks of the administration of drugs in labour. Also, if analgesics and anaesthetics are to be given, they entail an additional expenditure of time on the part of the medical attendant. They also involve skilled assistance in many cases, and the expense may be almost prohibitive except for hospital patients and those among the well-to-do. But the question must be discussed and some solution found, since the public is insistent in its demand.

Sedatives tend to prolong labour rather than shorten it in many cases, by diminishing the expulsive forces of the uterine contractions. This adds to the risks of labour for the mother, but more especially for the child. We must therefore have a thorough knowledge of the action of sedative drugs, and only employ those which give the maximum of relief with the minimum of danger. The problem is intensified by the fact that childbirth differs from a surgical operation. Much depends on the temperament of the patient, her environment, and her uterine contractions. The process of labour is prolonged in comparison with surgical conditions, and two lives have to be considered. Some women have little or no suffering; others under the same obstetrical conditions suffer acutely. Each case must be treated individually, and experience and caution are necessary.

In the Report of the Government Departmental Committee on the Training and Employment of Midwives, which was issued in 1929, it was urged that some professional

body should make a pronouncement as to the advisability and place in labour not only of anaesthetics, but also of analgesics and sedative drugs in general. A response was made by the British Medical Association, and a report of a committee was issued in April, 1930. The main expression of opinion was that of caution, and that any further expansion of the uses of anaesthetics and analgesic drugs in non-operative cases would be associated with danger to the mother and child. The question was left very much as it had been. The report may be of value in view of the present public agitation favouring the indiscriminate use of anaesthetics in all midwifery cases, but it does not give much help or encouragement to those of us who are anxious to relieve suffering whenever it is possible in obstetrical practice.

The opinion of this committee will be referred to later with regard to the use of special drugs. It is by frequent discussions between representative members employed in the practice of anaesthetics in obstetrics and in general practice that we shall in time gain useful information as to the most suitable methods to employ; we may eventually find the perfect method which will give complete relief without any risks to the two lives concerned.

The problems for discussion are the management of the stages of labour; the most suitable analgesics and their dosage for the first stage, and those for the second, combined or not, with anaesthetics; the differences between institutional and domiciliary practice; and the expense involved. We have also to consider the primary question: is relief of pain necessary in so-called normal labour? What are the dangers, complications, and the effects upon uterine contractions, retraction, and post-partum haemorrhage?

Although analgesia and anaesthesia may involve risks to the mother and child, I am firmly convinced that a considerable amount of our maternal death rate is due to lowered resistance from excessive fatigue, shock, and sepsis, the result of withholding relief during labour. In my clinic, where for the last nine years the use of sedatives, and, when necessary, light anaesthesia for the second stage and during delivery, is almost the routine method of treatment in ordinary labour cases, the patients are remarkably free from fatigue at the end of labour, and in a few hours show very little trace of their experience in the labour room. Mental suffering, especially fear, has an effect in lowering the resistance to shock and to sepsis. I am convinced that better results in the management of labour and in the reduction of maternal mortality will be gained by much greater attention to the relief of suffering in labour. Puerperal insanity can to some extent be prevented by the abolition of anxiety and suffering.

ANALGESIA IN LABOUR.

Analgesic or sedative drugs are administered in the first and second stages of labour, since pain is relieved without the loss of consciousness in most cases. Anaesthetics are employed to abolish consciousness, and they are used intermittently in the later second stage, while deeper anaesthesia is used during delivery. Deep anaesthesia is employed where operative measures are necessary.

In the first stage of labour no sedative, as a rule, is required until labour has become established and the patient is conscious of the discomfort of the uterine contractions. The general condition of the patient has to be considered, and also whether she is suffering from pain or only from anxiety and dread of the ordeal in front of her. Pain is felt in the back and abdomen, and she is restless and disturbed. The drugs most usually employed in the first stage are chloral hydrate, potassium bromide, opium and its derivatives, scopolamine, and numerous other sedatives, in combination or alone.

Chloral Hydrate.

Chloral hydrate in doses of 10, 15, or 20 grains is given by the mouth, or by the rectum in some cases; it is repeated as required. This is the rule for most sedatives in labour; no fixed time can be laid down, since patients and uterine contractions vary so much, but when pain is not present no sedative is necessary. Chloral hydrate is

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usually combined with 10 to 30 grains of potassium bromide given in sweetened water. There is almost no risk to the mother or foetus, the cervix is softened, and labour progresses although the patient may be asleep. The doses can be repeated during the second stage.

It is said that free bromine in the stomach may cause undue sickness. Plenty of water should be given during labour in all cases. Sometimes the effect of these drugs is slow, or of little benefit, and other drugs have to be resorted to.

Opium.

Opium and its derivatives have been used from time immemorial. This drug is an ideal sedative from the patient's point of view, inducing restful sleep, arousing no anxiety or discomfort, and aiding dilatation of the cervix, and therefore exercising a beneficial influence on the progress of labour. It is most valuable in the slow dilatation stage in primigravidae. It rests a tired uterus, and contractions begin again with renewed energy. Opium itself, in the form of the tincture or liquor, is not pleasant to take, and it may cause excitement or sickness. Its derivatives, such as morphine sulphate, omnopon or opoidine, panopon, are much more efficacious in their results if given hypodermically in doses of 1/6 to 1/4 grain. Dissolved in a 50 per cent. solution of magnesium sulphate and injected into the buttock the effect is prolonged. The magnesium sulphate can be repeated without the morphine, and the sedative effect is prolonged.

With such an ideal sedative, why try any other? It is said that the effect of morphine upon the foetus is fatal in some cases, and its administration is limited to the first stage, or at least not within three hours of delivery. I have used omnopon for many years in the first and early half of the second stage of labour, and I have rarely seen any ill effects from its use. The foetal heart requires constant auscultation during its administration in the second stage. It accelerates labour, and frequently obviates operative intervention. It relaxes the pelvic tissues, and prevents the patient inhibiting her muscular activities, but it requires to be given by experienced practitioners. Browne, in the examination of 300 foetal post-mortem examinations, found that four deaths could be traced to morphine administration in labour.

Scopolamine-Morphine.

Scopolamine-morphine—twilight sleep—introduced by Kronig and Gauss in Freiburg in 1907, caused a wave of enthusiasm among obstetricians, but its use was so mixed up with advertising commercial interests outside the profession, and so little was known as to its effects and dangers, that the number of practitioners who still employ this method is somewhat diminished. It is not used extensively in Britain, America, France, or in Germany. The advantages of the combination of these drugs are that pain is relieved, and the patient has no recollection of any suffering. There is no marked ill effect upon the patient. The uterine contractions persist, progress in descent of the foetus takes place, and there is no additional risk of post-partum haemorrhage. The third stage of labour is shortened. The scopolamine-morphine must be given early in labour, since it is more difficult to narcotize the patient if she has had experience of severe pain. Most obstetricians give only the initial dose of morphine (1/6 or 1/4 grain), and repeat the scopolamine in varying doses—1/150, 1/200, or 1/450 grain—as indications arise. The chief indication is obtained by means of testing the patient's memory of various objects given to her to recognize. Scopolamine can be repeated up to delivery.

The disadvantages of this method are numerous. It is essentially a form of treatment for the hospital or nursing home, since it requires isolation, complete quietness, and skilled and constant attention. There is sometimes considerable excitement on the part of the patient, which may cause anxiety to her relatives if the confinement is conducted in her own home. She may suffer from thirst, headaches, giddiness, and eye symptoms.

The chief objection is that the foetus may become affected, and a stillbirth may result; most practitioners put

this down to the initial dose of morphine. When successful the method seems ideal, but it can never become widespread, since it involves too much expenditure of time on the part of the practitioner, unless he has a special department with an experienced staff.

Scopolamine-morphine is not suitable if the labour is prolonged, or if operative delivery is necessary. Hyoscine is sometimes substituted for scopolamine, but it tends to prolong labour and to cause post-partum haemorrhage. A modified method of giving small doses of scopolamine during labour relieves pain to a great extent without inducing loss of memory; this does not require such constant attendance, and gives good results.

Adaline.

Adaline is valuable, given in doses of 5 to 10 grains by the mouth. I have had considerable experience of its use, and have seen no ill effects. It is easy of administration, and relieves pain in both stages of labour.

ANAESTHESIA IN LABOUR.

Although we look upon anaesthetic drugs as those which are usually administered by means of inhalation, there are other more local methods of obtaining relief from pain in childbirth, just as there are in surgery. It is somewhat difficult to classify the various anaesthetic drugs, since they differ according to their methods of administration.

The chief inhalation methods are those by means of chloroform, ether, and nitrous oxide gas.

Chloroform.

The administration of chloroform in surgical and obstetrical practice seems to be more or less geographical. In Scotland, the home of Simpson, it is more used than in England, where ether is the anaesthetic of choice. Some practitioners prefer ether for surgical operations, but show a partiality for chloroform in obstetrics. It is said that a pregnant woman is very tolerant of chloroform inhalation, and that it does not require such a skilled administrator as in the case of surgical conditions. This is probably due to the fact that chloroform anaesthesia is, as a rule, light and intermittent during labour—*à la reine*. Indeed, during the second stage, chloroform can be given by the patient herself in some cases. The usual method is to give a few drops on a mask and let the patient gently inhale it. As delivery approaches, the quantity administered is increased according to the degree of anaesthesia required. During expulsion, the most painful part of labour, complete anaesthesia may be necessary in some cases. In the third stage of labour it is not necessary to give an anaesthetic unless manual removal of the placenta is to be undertaken. For the satisfactory repair of lacerations it is, as a rule, necessary to anaesthetize the patient.

Chloroform has a soothing effect upon a nervous patient when given only in minute quantities in labour. It often causes the pains to become more regular, and it relieves spasmodic contractions of the perineum and other structures due to the fear of pain on the part of the patient. The more rapid advance of the presenting part can be observed in cases of light chloroform anaesthesia. During delivery more control is obtained, and therefore the risk of lacerations is diminished. The effect of an anaesthetic relieves to a great extent the anxiety of the patient's relatives.

The disadvantages of deep chloroform anaesthesia are difficult to estimate, since other factors, such as operations and complications, are usually involved. The uterine contractions may be diminished or abolished with the consequent prolongation of labour and the possibility of post-partum haemorrhage. Chloroform is contraindicated in cases of liver involvement, such as acidosis, toxæmia, and hepatic atrophy. In eclampsia chloroform is given to allay convulsions, but, if there is any serious liver involvement, its administration is accompanied by risk, and chloroform poisoning may ensue. In cardiac conditions chloroform may cause collapse and death; this is more frequent after delivery than during labour. The foetus is not much affected by chloroform unless the administration is prolonged or deep. It is said that chloroform is partly eliminated by the expulsion of the placenta. It should not

be given in a room with a gas fire, since decomposition of its elements may occur and death from poisoning result.

The committee of the British Medical Association recommends the use of pituitrin to counteract the paralyzing effect of chloroform upon the uterine contractions. In my own experience this drug is dangerous in any case where there is delay in the second and third stages of labour. Its uses are mainly for haemorrhage after delivery of the placenta, and as a means of sensitizing the uterus in order to bring on labour.

Ether.

Ether is preferred to chloroform by many practitioners as it is said to be safer; this applies more to general surgery and deep anaesthesia than to midwifery practice. Extensive use is made of it in England, and especially in cases where chloroform is contraindicated; it can be given by the patient herself in small doses. Ether is pleasant to take, and often acts as a stimulant to the heart; it does not, as a rule, diminish uterine contractions, and is useful in cases of operative intervention, such as forceps, Caesarean section, and for the repair of lacerations. It has no bad effects upon the foetus if its administration is not too prolonged or deep. The disadvantages are that it is sometimes slow in action, and needs a special apparatus and a skilled administrator. The chief drawback is its irritating effect upon the respiratory passages; it is therefore unsuitable if pulmonary complications are present or there is oedema of the lungs, as in nephritis. Some of the risk can be reduced by giving ether in a warmed apparatus, but it causes more sickness than chloroform. Ether is inflammable, and care must be taken in domestic practice or in operating rooms where electric appliances, such as the cautery, are in use. Sometimes a mixture of alcohol, chloroform, and ether is given, but not so frequently as in surgical work.

Gwathmey of New York has advocated the instillation of an emulsion of ether into the rectum during labour in combination with the intramuscular injection of morphine in a solution of magnesium sulphate. This method has gained a number of supporters, and in some cases gives excellent results, which improve as the technique becomes more perfected; it is inexpensive, and is easily carried out in a private house. The instillation takes time, and undue excitement on the part of the patient may follow it. There is danger of irritation, and even of sloughing of the rectum, if the ether emulsion is not properly prepared. The amount of absorption of ether must vary to some extent, and cannot be regulated in the same way as by the inhalation method.

Nitrous Oxide.

The administration of nitrous oxide gas and oxygen is undoubtedly the most ideal method of obtaining anaesthesia in midwifery practice; it is safe, relieves pain, and does not interfere with the progress of labour. It may be employed during uterine contractions, and continuously towards and during delivery. It has no harmful effects upon the foetus. After birth, before the cord is severed, oxygen alone may be given in a case of asphyxia. The after-effects of gas and oxygen are negligible. This method is especially useful in short operations, such as induction, version, forceps delivery, and repairs. It is safe in toxic, cardiac, and pulmonary complications. It is recommended to begin with gas and oxygen, and to decrease the gas as each labour pain nears completion. The disadvantages are that the apparatus is expensive and cumbersome for private practice; a skilled anaesthetist is necessary. Sometimes the patient becomes excited and difficult to anaesthetize. If there is headache after the recovery of consciousness the mixture has contained too much nitrous oxide.

Ethylene.

A mixture of equal parts of ethylene and oxygen has been advocated lately by some American obstetricians (de Lee, Blevis). There is said to be no excitement, the induction period is short, and it is safe in cardiac cases. It has no irritating effect upon the lungs or kidneys. It is useful in light intermittent anaesthesia, and can be supplemented by ether for delivery. It has no ill effects upon the foetus unless prolonged. Its chief fault is that it is highly explosive.

Local Anaesthesia.

Local anaesthesia is advocated by some obstetricians, more especially for the relaxation of the tissues of the pelvic outlet. Rose, who employs novocain in both stages of labour, gives intradermal infiltrations of the abdominal wall in order to abolish the pain of the skin reflexes; in the second stage he injects it slowly into the perineal structures. He considers that lacerations are usually prevented, and that, if they occur, their repair is easily effected.

De Lee employs procaine combined with adrenaline as a local injection in Caesarean section operations. Browne uses local anaesthesia entirely for the immediate repair of the perineum, injecting 4 to 6 drachms of a 2 per cent. solution of novocain with 1 minim of 1 in 1,000 adrenaline solution to each drachm of novocain. The infiltration of the perineum and vagina is obtained by a hypodermic needle. Perfect relaxation and anaesthesia result without the discomforts which follow inhalation methods.

Spinal Anaesthesia.

Spinal anaesthesia is employed in surgical practice, and also in midwifery to some limited extent; it does not lessen uterine contractions or interfere with retraction, and therefore does not cause post-partum haemorrhage. It relieves pain by paralyzing the pelvic area. There are no toxic effects upon the liver or kidneys, and it does not seem to harm the foetus. Burns especially advocates its use in Caesarean section, in cardiac cases. It has been found to give good results in cases of forceps, version, and breech deliveries. It requires a skilled administrator, especially in obstetrics, and in some cases its effects are very variable. Until it has been more widely employed it is difficult to give an opinion on its merits in midwifery practice, but there is no doubt that it has a place in cases where inhalation methods are contraindicated. It is not always sufficiently prolonged in its effects in the case of a primigravida. Headache is a symptom, but this can be prevented to some extent by using a very fine short needle for injection. The drugs most frequently employed are stovaine or novocain; cocaine is considered dangerous by most obstetricians. Much of the success of the method depends upon technique and the injection of the drug low down in the cord, so as not to interfere with the uterine contractions.

CONCLUSIONS.

Each maternity case must be given individual attention with regard to the most suitable sedative and anaesthetic to be employed. The age, parity, temperament, general health, and complications, if present, must all be carefully considered. Obstetrical anaesthesia is not quite comparable with the surgical form. The pain is prolonged, and has to be combated with sedatives as well as with anaesthetics; the effect of these sedatives must be taken into consideration when an anaesthetic is decided upon.

Light anaesthesia is of little use in surgery, while it is generally employed in midwifery practice, except in cases where operative intervention is required. The action of the uterus must be maintained, and haemorrhage after delivery must be prevented as far as possible. The expenditure of time, with its consequent financial complications, is a consideration. It is desirable that private patients should have the continuous attendance of the practitioner during labour, if sedatives or anaesthetics are to be given, just as in hospital practice; yet it is impossible to demand this unless adequate financial compensation is made by the patients for the loss of practice elsewhere.

In surgical practice only one life is involved. In midwifery the interests of the child are of great importance in uncomplicated cases where the only consideration for treatment is the relief of pain to the mother. Perhaps the safest sedative is chloral and potassium bromide, and the safest anaesthetic is gas and oxygen, from the point of view of the foetus.

It is a common mistake to carry out violent methods of artificial respiration if the infant does not breathe immediately after birth. We have to remember that it is narcotized to some extent, and requires time to recover; warmth, rest, and clearance of its respiratory passages are sufficient in most cases of delayed respiration, but CO₂ and oxygen should be given if there is any undue delay.

Many an infant loses its life from misguided methods of restoring animation, such as bathing and artificial respiration.

In England, where there is so much discussion at present as to the advisability of every woman in labour having relief from suffering, the question is, What is to be done about the patients under the care of midwives? These number about 60 per cent. of all the cases of the country. Are these patients to be excluded from all methods of relief from painful labour? Are they to be attended by an anaesthetist, and, if so, who is to bear the expense? If midwives are to be permitted to give sedatives, or even anaesthetics, it will involve general training in surgery and medicine and special training in sedative administration. This is a real problem, and the opinion of the medical profession is divided.

There is room for much reform in the management of labour by medical practitioners, and perhaps that is the first step to be taken. The agony suffered by parturient women is one which has called for relief throughout the ages; it should appeal to every humane individual in the medical profession.

RADIOGRAPHY DURING OPERATION FOR RENAL CALCULUS.

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(With Special Plate.)

Is a so-called recurrent renal calculus really a recurrence, or is it a case of a stone, or a fragment of a stone, being left behind at the initial operation? Fortunately it is not common to have a recurrence, but cases do recur. Further, what ultimately happens to a kidney which is traumatized during the operation of nephrolithotomy?

For some years, whenever x-ray facilities have been available in the operating theatre, I have taken the opportunity of x-raying an exposed kidney which was either known to contain a calculus or was suspected of containing a calculus which did not show up on an ordinary radiogram. My object has been twofold: first, to locate accurately the site of the stone so as to damage the kidney as little as possible during its removal; secondly, to be certain by a further radiogram, after removal of the calculus, that no fragment has been left behind. Even a small calcareous fragment left behind is sufficient to form the nucleus of a further stone.

Where a calculus is concealed in a calyx it may not be possible to palpate it either through the solid tissue or through the pelvis of the unopened kidney. I feel certain that when the solid part of the kidney is incised for an adequate search—usually so that the *inside* of the renal pelvis can be palpated—the subsequent suturing up so constricts the blood supply that the incised portion of the kidney becomes functionless.

The x-ray apparatus which I use for this purpose is an ordinary Dean 16-inch coil set. It is kept entirely for work necessary during operations, and when out of use it is housed in a large airtight cupboard in the operating theatre. It can be mounted and ready for use in three minutes.

When operating in a renal case my patient lies on the sound side, with the diseased side uppermost. After exposure of the kidney, and when all bleeding points have been secured, so that the field is as dry as possible, the film, in its paper covering, is wrapped in a dry sterile cotton cylinder—that is, an arm sleeve—and placed in position. The film is pushed down into the wound in the case of a short renal pedicle, but there is usually no difficulty in persuading the kidney to lie upon the film while the skiagram is being taken. An exposure of one second has always sufficed. It is emphasized that the operation field must be *dry*, otherwise the film is ruined by the damp; further, that sepsis may permeate through the blood-moistened sterile towel and result in a pyogenic wound infection. A technician stands by and develops the film,

which has usually been available in three minutes, never longer than five minutes, after its receipt. I have seen the method used of trying to view the exposed kidney through a fluorescent screen. The technical difficulties of screening, however, are greater, for the theatre must be darkened; the surgeon's eyes take time to become accustomed to the darkness before he can see adequately; and small calculi are apt to be missed. In my opinion, taking a film is preferable, as it is much more certain.

When the calculus has been located, and its size and shape noted, it is removed by the smallest possible incision. After its removal another radiogram is taken by a similar technique to verify the complete removal of the stone or stones. The kidney tissue incision is closed by catgut sutures and the wound area drained by a tube.

I have chosen four typical cases.

1. A case of renal colic in a very stout female, where ordinary radiography and pyelography failed to disclose a calculus. X-ray examination of the exposed kidney revealed a stone and its location. After nephrolithotomy a further radiogram showed normal shadows.

2. A calculus, previously seen by x rays, was accurately located by radiography of the exposed kidney at operation; a further radiogram was taken of the exposed kidney after nephrolithotomy.

3. A case of multiple calculi located at operation by x rays where, after all the calculi had been thought to be removed, a further radiogram of the exposed kidney disclosed a calculus left behind.

4. Eight years previously a small renal calculus had defied the surgeon at a nephrolithotomy until the kidney had been slit up from pole to pole. Pyelography showed that this traumatized kidney had become functionless, owing to strangulation of the blood supply by the catgut sutures employed in sewing up the kidney.

Particulars of these cases are recorded below.

CASE I.

On September 6th, 1928, M. W., aged 50, a very stout female, was admitted for investigation of acute attacks of left-sided typical renal colic. Radiography failed to show any abnormal shadows, despite good radiograms. Cystoscopy showed a basal cystitis with ulceration in front of both ureteric orifices, but particularly the left-sided one. The ureters were catheterized, and subsequent distensions of the left renal pelvis caused the acute pain of which she had complained.

Pus cells were obtained in the urine withdrawn from each kidney; the phenolsulphonephthalein excretion from the right kidney was $7\frac{1}{2}$ per cent., compared with only $1\frac{1}{2}$ per cent. from the left kidney. The blood urea was 60 mg. per 100 c.cm. The phenolsulphonephthalein test failed owing to only a portion of the dye reaching the vein. Pyelography showed a normal right pyelogram with a small degree of hydronephrosis of the left side.

A diagnosis of uric acid calculus was made, and the left kidney exposed by operation. A radiogram (Fig. 1) showed a small uric acid stone in the middle of the lower pole of the kidney. The calculus was removed through a small incision to the cortex. A further radiogram (Fig. 2) showed that all the fragments had been removed. The renal cortex was sutured with catgut; the patient made an uneventful recovery; no urine ever leaked from the wound.

Had the first radiogram of the exposed kidney failed to show a stone, the kidney of course would not have been opened.

CASE II.

L. W. B., aged 36, was admitted with a history of right-sided renal colic, from which he had been suffering for three years. It prevented him from carrying on his practice as a dental surgeon. X rays showed a shadow in the area of the right kidney. His blood urea was 60 mg. per 100 c.cm.

Cystoscopy showed a subacute cystitis. Urine obtained from each kidney by ureter catheterization was found to be free from pus on microscopic examination. Distension of the renal pelvis by a measured quantity of fluid revealed that the capacity of the right side was three times greater than the left side. The phenolsulphonephthalein excretion of the right kidney was only $7\frac{1}{2}$ per cent.; that of the left was $12\frac{1}{2}$ per cent. Pyelography disclosed a normal left side, with hydronephrosis on the right side. Further, the shadow previously seen on the right side was incorporated in the pyelography shadow.

After exposure of the kidney the calculus could not be felt. The radiogram showed it to be in an upper calyx (Fig. 3). It was removed, along with a small calcareous flake. Another radiogram showed absence of any foreign body (see Fig. 4).

He made an uneventful recovery, without leakage of urine from the wound.