**Spinal anaesthesia by cocaine in gynaecology : with observations on eighteen cases / by Arnold W.W. Lea.**

[*Reprinted from* "THE MEDICAL CHRONICLE," *December*, 1901.]




# Spiňal Anæsťhesia by Cocaine iň Gynæcŏlogy.

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SHERRATT & HUGHES,
*Booksellers and Publishers,*
27, ST. ANN STREET, MANCHESTER.

# SPINAL ANÆSTHESIA BY COCAINE IN GYNÆCOLOGY.

## With Observations on Eighteen Cases.*

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The production of complete surgical analgesia by means of injections of cocaine into the subarachnoid space in the lumbar region has been brought prominently before the medical profession during the last year, and numerous operations have now been performed by this method.

The value of lumbar puncture as a diagnostic and therapeutic measure was first drawn attention to by Quincke in 1891,[1] but it was not until April, 1899, that Bier,[2] of Kiel, published his clinical experience of the anæsthetic effects of solutions of cocaine injected into the subarachnoid space in the lumbar region, and completely demonstrated the success of the method.

It is interesting to note that this discovery was foreshadowed by Dr. Leonard Corning,[3] of New York, in 1885, who made numerous investigations on the effects of cocaine on the nerve trunks, and even adopted it for surgical purposes.

Tuffier, of Paris, was one of the earliest operators to use this method on a large scale. In the *Semaine Médicale*, December 6th, 1900, he recorded sixty-three operations performed under

* A paper read before the Manchester Medical Society.

1. *Berliner klinische Wochenschrift*, 1891, pp. 929—965.
2. *Deutsche Zeitschrift für Chirurgie*, 1899, p. 361.
3. *New York Medical Journal*, 1885, No. 42, p. 483.

"medullary narcosis," and has since then employed the method in several hundred cases. He has further elaborated, as a result of numerous investigations, a technique which is now mainly adopted by other operators, and is likely to become classical, although there is scope for much further improvement.

During a visit to Paris in May of this year, I had an opportunity of seeing M. Tuffier perform operations by this method, and as a result I decided to make use of it in selected cases, especially in patients who have a great dread of general anæsthesia, or in whom some contra-indication to the administration of a general anæsthetic exists. My earlier operations were strictly limited to this type of case, and as the method was a complete success, I have of late adopted it rather more frequently, and have now used "medullary narcosis" in eighteen cases; an analytical table with brief notes of these cases is given below.

The literature of the subject is already very extensive, as a large number of operations have been performed in this way during the past year, especially on the Continent and in America.*

The physiological effects of cocaine solutions applied locally to the nerve centres of the brain and spinal cord have been extensively investigated by Picard and others, and quite recently by Pitres and Abadie, of Bordeaux.[4] In this paper I propose, however, to limit myself to a short account of the technique and surgical value of this method.

*Anatomical points.* The spinal cord ends, in the adult, about the middle of the body of the 2nd lumbar vertebra. Below this the spinal canal is occupied by the "cauda equina," consisting of the conus medullaris, with the lumbar and sacral nerve trunks. These float in the subarachnoid space, which in this region is somewhat dilated to form a small cul-de-sac or reservoir for the cerebro-spinal fluid. Externally this is enclosed in the firm sheath of dura mater, which extends downwards into the sacral canal.

* Full references to the literature of this subject are given in Tuffier's recent monograph. "L'analgesia Chirurgicale par voie Rachidienne" (Masson), Paris, 1901. A critical review will also appear in the *Journal of Obstetrics and Gynæcology of the British Empire*, January, 1901.

4. *Archiv. de Neurologie*, October, 1901.

The subarachnoid space may be punctured between any of the lumbar vertebræ. It is found, however, that the space between the 4th and 5th vertebræ is the largest and most accessible, and is readily identified by surface markings. It is this space which is recommended by M. Tuffier. For the puncture, a needle is required sufficiently long to traverse the planes of tissue between the skin and the subarachnoid space. This needle may be made of steel, but this readily becomes corroded, and it is better to use a platinum needle with an iridium point. The needle should be of small diameter, and it is important that the point of the needle should be sharp but short, to avoid the possibility of injuring nerve structures. Tuffier's needle is 9 cm. long, with a diameter of ·8 mm. A Pravaz syringe, with a glass barrel and asbestos packing, to hold 2 c.c. (30 min.) of fluid, is required. The needle and syringe are readily sterilised by boiling. The cocaine solution (hydrochlorate) must be most carefully sterilised. This is not easy to do. I have, therefore, always made use of capsules of solution of hydrochlorate of cocaine, as adopted by M. Tuffier. Each capsule contains 2 c.c. of a 2 per cent. solution of cocaine, equivalent to one-fifth of a grain.

It will be noticed that a very small quantity only of cocaine solution is required to produce complete analgesia; but it is essential that this should not be exceeded, as otherwise serious toxic symptoms may arise. The details of the injection are as follows:—

I. The skin of the lower dorsal and lumbar region is most carefully sterilised some hours before the operation, and also immediately before the injection is made.

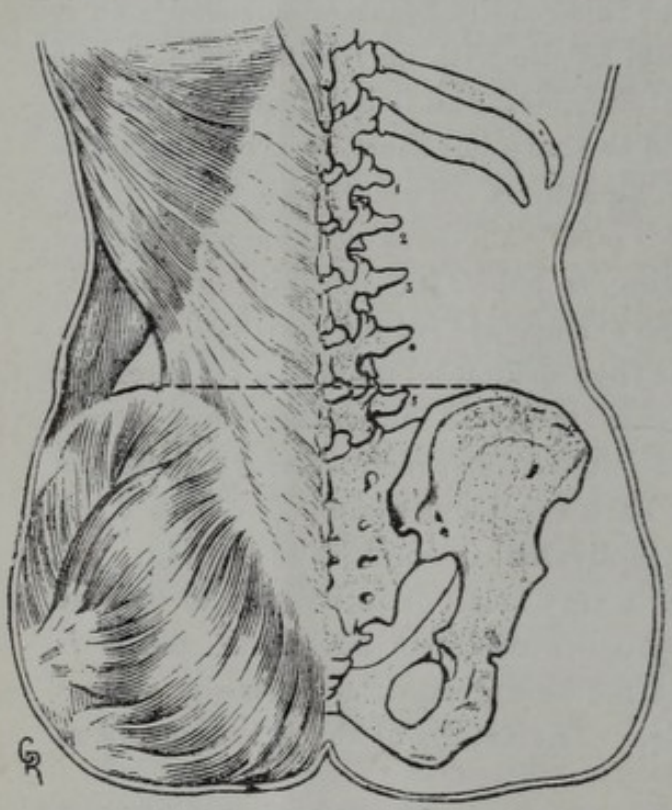
II. The patient is placed in a sitting posture on the table, and, before making the injection, is told to sit forward and bend the back. In this position a definite interspace is obtained between the laminæ of the 4th and 5th lumbar vertebræ.

III. The anatomical point for making the puncture is now selected. The spine of the 4th lumbar vertebra is felt for, and in thin people is always easily recognised. If it is not obvious, a line joining the highest points of the two iliac crests will be found to cross the 4th lumbar spine. This may be confidently relied upon as a guide. The point for making the puncture is

immediately (1 cm.) below and to one side of the 4th lumbar spine.

IV. The needle and syringe are previously sterilised by boiling, and the capsule of cocaine solution is now broken, the solution poured into a sterilised medicine-glass, and the syringe is filled, care being taken to expel all air.

V. The puncture is now made, the needle being thrust slowly



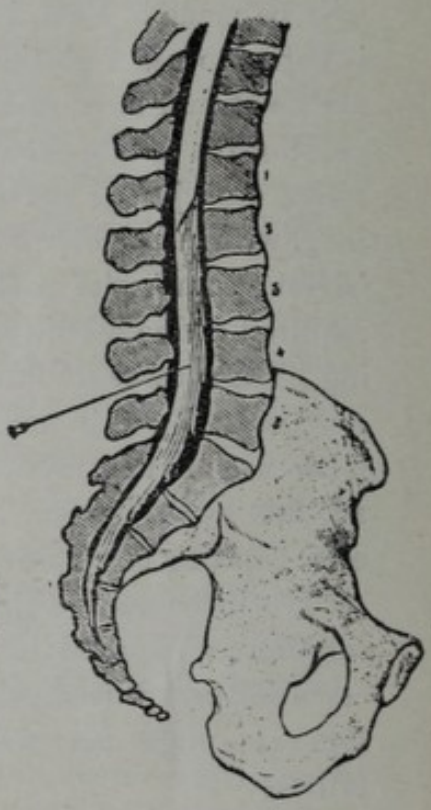


FIG. 1. FIG. 2.

FIG. 1. The dotted line crosses the level of the 4th lumbar spine.

FIG. 2. The point of entry of the needle, which does not however touch the cauda equina as the nerves are placed laterally (after Tuffier).

and steadily downwards and slightly inwards, for a distance of $2\frac{1}{2}$ to 3 inches, usually. It will enter the subarachnoid space, as shown by a diminution of resistance and the cerebro-spinal fluid escaping at the end of the needle. This is conclusive evidence that the subarachnoid space has been entered. The syringe is now screwed on to the needle, and the cocaine solution (previously warmed) very slowly injected, usually occupying about one minute.

VI. The needle is now withdrawn, and the puncture sealed up by celloidin.

The pain of the injection is trifling, but it is well to warn the patient of the puncture, as a sudden movement or muscular spasm may displace or bend the needle. The pain may be entirely avoided by freezing the skin, or by injecting a few drops of cocaine solution previously.

*Difficulty in entering subarachnoid space.* It is essential to success in inducing analgesia, that the subarachnoid space be clearly entered by the needle, and this is definitely ascertained *only* by the flow of clear cerebro-spinal fluid. Occasionally, during its introduction, the needle impinges on the lamina; a slight movement of withdrawal and alteration of direction is usually all that is required to enter the space. The needle may be apparently in the space and yet no fluid escapes, due to the point of the needle being entangled in the membranes; slight rotation of the needle is generally sufficient to cause the fluid to flow freely. Great variations exist in the cerebro-spinal fluid pressure. The fluid usually escapes drop by drop, or it may flow out in a steady stream, or even in distinct jets; very rarely the pressure is so low that no fluid escapes. If the patient coughs slightly, it will generally flow.

*Escape of blood through the needle.* A few drops of blood may appear at the end of the cannula, due to the puncture of a small vein. This is not of consequence if the fluid soon becomes clear. If, however, blood only escapes, the needle should be withdrawn and a second puncture made.

In my series, difficulty was met with in three cases only. In one case no fluid escaped, and a second puncture was made—successfully. In another case a drop or two of blood appeared, but the fluid then became clear, and the injection was then made with success. In a third case (No. 18), although at first clear fluid appeared, this was followed by a flow of blood. As I believed the needle was in the subarachnoid cavity, I injected the cocain solution. No analgesia, however, was produced, and I performed the operation (ovariotomy) under chloroform. This is the only case in which the injection failed to induce analgesia.

*Results of the injection.* Complete analgesia of the body

below the diaphragm is induced within five to ten minutes, or even earlier; very rarely, fifteen to twenty minutes may be required. The height to which the analgesia extends is variable. It often reaches as high as the 4th rib, and sometimes up to the axilla. The early symptoms are tingling and numbness of the feet and legs, accompanied sometimes by cramp-like pains for a few minutes. Slight sensations of nausea are common, and occasionally the patient may vomit. The pulse is slightly quickened, and the tension is somewhat reduced. Respiration is usually unaffected. The sphincter ani may be relaxed, and gas or fæces occasionally escape. Incontinence of urine was never observed. Vaso-motor phenomena are not infrequently met with. The patient may become somewhat flushed and perspire freely. In other cases the patient becomes pale, usually when nausea is present.

In two cases I observed dilatation of the pupils during the operation, and one patient (No. 11) had troublesome diplopia for several days after the operation.

The operation may usually be commenced five to ten minutes after the injection, and complete analgesia may be relied upon for 1 to $1\frac{1}{2}$ hours. The duration of the analgesia is variable. In some cases it may only continue for 45 minutes, or, again, it may be present for $2\frac{1}{2}$ to 3 hours. There are certain details which are of importance in carrying out operations upon a conscious individual, and which add much to the patient's confidence and comfort. It is well that someone should, from time to time, reassure her. If the patient feels flushed and hot, gentle fanning is most refreshing. If she complains of thirst, a little soda-water may be given. The ears should be filled with cotton-wool, and a handkerchief placed over the eyes. Silence should, as far as possible, be observed during the operation, and the instruments handled without noise. By these measures the patient is relieved from undue nerve tension. I have never found any difficulty in controlling the patients during the operation, and usually they express themselves as feeling very comfortable. The Trendelenburg position, to a moderate degree, is very well borne. I have found, however, that Clover's crutch often appears to produce sensations of cramp in the legs. It is advisable, therefore, if the

lithotomy position is required, that the legs should be supported by two nurses.

It is not unfrequent for patients to complain of nausea or even to vomit during the operation. This is a disadvantage of this method, and in abdominal surgery especial care should be taken to protect the bowels carefully with gauze pads or sponges. For this reason also I have not used this method for vaginal hysterectomy, since straining at a critical stage of the operation might lead to prolapse of the bowel, which is a serious accident. Nausea or slight sickness were present during the operation in seven cases, *i.e.*, nearly 40 per cent.

The operations carried out by this method are as follows:—

*Abdominal Section.*

| | |
|---|---|
| Ovariotomy - - - - - - - - - - - - - - - - | 2 cases. |
| Ovariotomy (failure of injection, chloroform given) | 1 ,, |
| Cæsarean section* - - - - - - - - - - - - - | 1 ,, |
| Removal of appendages for inflammatory disease - | 2 ,, |
| Ventro-fixation with resection of ovary - - - - | 1 ,, |
| Exploration for myoma and pregnancy - - - - | 1 ,, |

*Vaginal Section.*

| | |
|---|---|
| Pelvic abscess - - - - - - - - - - - - - - | 1 ,, |
| Acute pyosalpinx - - - - - - - - - - - - - | 1 ,, |
| Amputation of cervix and colporraphy - - - - | 1 ,, |
| Ligature of uterine artery - - - - - - - - - | 1 ,, |
| Complete rupture of perineum - - - - - - - - | 1 ,, |
| Exploration and curettage - - - - - - - - - | 3 ,, |
| Hæmorrhoids - - - - - - - - - - - - - - - | 2 ,, |

In all of these the analgesia was complete with three exceptions.

No. 4. No pain was felt during the abdominal section; but, in removing a lipoma of the labium, 45 minutes after the injection, pain was felt, and a few breaths of chloroform were given.

No. 5. The cervix was incised to explore the uterus, and the uterine artery was ligatured to control recurrent menorrhagia.

* This operation was performed by Professor Sinclair at the Southern Hospital in May, 1901.

The patient said that she felt some pain all the time, but it was quite bearable.

No. 18. Medullary narcosis entirely failed, owing to the solution not entering the subarachnoid space. I might have repeated the injection, but, as the patient was rather nervous, chloroform was given.

During these operations I have never observed any symptoms suggesting immediate or remote danger from the injection, and there has been an entire absence of any of the usual signs of shock.

*Symptoms arising after operation.* The sequelæ of medullary narcosis are mainly three, and each merits separate consideration.

I. *Sickness.* In many cases, beyond the slight nausea or sickness a few minutes after the injection, no further vomiting occurred. In 13 cases there was no sickness whatever after the operation, and the patients were anxious to have food. In one case (No. 3) the patient had acute pelvic peritonitis at the time of operation, and had been sick for some days previously. The vomiting continued for three days after the operation, but this was probably not the direct result of the injection. In three other cases sickness was present for 24 hours, but was not serious. In case No. 11 (Cæsarean section) the patient became sick on the third day, but this passed away when the bowels were freely evacuated. It may therefore be claimed that, with this method, sickness is a less prominent or serious symptom than after the administration of a general anæsthetic.

II. *Rise of temperature.* This is an almost constant phenomenon, and appears to be quite independent of the nature of the operation; it usually occurs six to eight hours afterwards. In 9 cases (50 per cent.) a rise of temperature was observed on the evening of the operation. In one case (No. 8) this reached 103·8°, and was accompanied by a slight shiver. In the remaining cases the temperature varied from 100° to 102°. It subsided within 24 hours in all the cases. The pyrexia is clearly due to the injection, and is probably to be attributed to disturbances of cerebro-spinal fluid pressure. It does not, however, appear to have any serious significance.

III. *Headache.* This is very constantly present as a sequel

to medullary narcosis. In my series, severe headache occurred in 7 cases, and slight headache, lasting 12 to 24 hours, in 4 cases. In 7 cases no headache was present. The pain is generally occipital, but may be frontal and accompanied by aching at the back of the eyes. It may continue as long as three to four days after the operation (No. 9).

The cause of the headache is not certainly known. It may be due to alterations in cerebro-spinal pressure, or to the gradual elimination of cocain by the brain. It does not appear to depend on the amount of fluid withdrawn by the needle, though in some cases it has been particularly severe if much fluid has been evacuated. It also follows injections of distilled water only into the subarachnoid space. The most probable cause appears to be some alteration in the cerebral circulation, but the subject is not yet worked out. Various drugs appear to relieve it.. Phenacetin, in gr. x. doses, given immediately after the operation, diminishes or checks it; nitro-glycerin and hydro-bromate of hyoscin have also been strongly recommended. If the headache is really severe, morphia will give certain relief. In every case the headache passes away completely, and no after effects have been recorded.

This method of spinal anæsthesia is not free from all risk, and mention must be made of the various complications which may possibly arise.

I. *Mechanical injury.* The minute puncture of the membranes made by the needle is not likely to cause any damage to the nerve structures of the cauda equina, which float about freely in the subarachnoid space (Quincke). Even if these structures were punctured, it is not probable that any serious results would follow. It is, however, essential that the needle should have a short point.

II. *Sepsis.* This is a real danger, and can only be avoided by scrupulous care to ensure complete asepsis of all instruments and materials used. If this method became generally adopted by those unfamiliar with aseptic technique, it is quite possible that disasters might occur. This risk, however, can be practically eliminated, and a very large number of punctures have now been made by various surgeons without any septic symptoms having

been noted. To prevent the possible introduction of skin organisms by the needle, a minute incision may be made with a scalpel before making the puncture.

III. *Difficulty in entering subarachnoid space.* This may be met with in very stout and muscular patients, in whom it is not easy to recognise the lumbar spines and iliac crests; or, again, if any deformity of the spine is present, it may be necessary to make more than one puncture. If the needle is directed too far laterally, it will impinge upon one of the laminæ, and must be partially withdrawn; or if, again, it penetrates too deeply, it may enter the body of the vertebra or an intervertebral disc. If difficulty is met with, it is best to remove the needle and make a fresh puncture.

IV. *Failure to produce anæsthesia.* Some persons appear to be peculiarly insensitive to the influence of cocaine, and cases have been recorded in which, although the injection was clearly made into the subarachnoid space, no anæsthesia was produced. Some of these cases are explained by failure to use an active preparation of the drug, or by the use of too large a needle,[6] in which case the fluid may escape through the needle puncture. In other cases, however, an idiosyncrasy appears to exist, in which even large doses of cocaine fail to produce complete anæsthesia.

V. *Organic changes in the cord or meninges.* No cases have been recorded in which any symptoms of this nature have followed medullary injection. Nicoletti, of Naples (Internat. Congress, Paris, Aug., 1900), has made numerous experiments on animals, and has found that no histological lesions develop as a result of cocaine injections into the spinal cord in subjects with healthy nervous systems.

VI. *Toxic effects of cocaine.* It is well known, that the susceptibility to cocaine varies much in individuals, and alarming symptoms have followed the hypodermic injection of small quantities, not exceeding half a grain. A number of cases have been recorded during the past year in which evidences of the poisonous effects of cocaine have followed injections into the subarachnoid space. In all of these, however, the dose has been greater than

6. Goldan, *Philadelphia Med. Journ.*, Nov. 3, 1900.

that laid down by Tuffier as the maximum safe one, which is one-fifth of a grain. If this amount is exceeded, dangerous symptoms may develop in rare cases. Thus, after a dose of two-fifths of a grain, symptoms of collapse, with vomiting, pallor, and sweats have been observed. These symptoms may immediately follow the injection, or may come on some hours afterwards. Attention was specially called to these symptoms by two Roumanian surgeons—Pitesci, who had operated upon 125 cases, and Severeanu (80 cases)—at the International Congress of Surgery in August, 1900. Great care, then, should be taken not to exceed one-fifth to one-fourth of a grain of cocaine solution for subarachnoid injection.

In my series I have never observed any evidence of cocaine poisoning. The symptoms which usually follow the injection—sickness, headache, and rise of temperature—are due rather to disturbances of cerebro-spinal pressure than to the direct toxic effects of cocaine, and have been observed to follow injections of saline fluid into the subarachnoid space. As a precaution, I have in some cases injected half-a-grain of cocaine subcutaneously the day before making the lumbar puncture, so that any undue sensitiveness to the drug, if present, may be discovered before the operation.

VII. *The possibility of death following the injection.* A number of cases have been recorded in which rather sudden death has followed lumbar puncture carried out for exploratory purposes or for the evacuation of cerebro-spinal fluid. Gumprecht[7] has collected 18 cases from various clinics, in which death followed quickly after lumbar puncture and could only be attributed to this cause. These, however, were all in patients suffering from serious affections of the central nervous system—hydrocephalus, cerebral tumours, or meningitis. Tuffier, in his series of 250 cases, read at the International Surgical Congress, had 5 deaths. Four of these could in no way be attributed to the anæsthetic, but in one case death occurred the next day. The patient was found to have extreme mitral stenosis, with multiple emboli in the lungs. It is very doubtful if this could in any way be due to the medullary injection. Pitesci, however,

7. *Deutsche med. Wochenschrift*, June 14, 1900.

stated that he had knowledge of two deaths which had occurred in Roumania, but no details were given. It is of extreme importance that any fatal cases should be published, but, so far, no unequivocal case has been recorded, although if the dose of one-fifth of a grain, which is sufficient for all major operations, be exceeded, dangerous symptoms of cocaine poisoning may ensue.

### Scope and Value of Spinal Anæsthesia.

This method is at present in its initial stage only, and the technique is far from being perfected. It is at present impossible to predict the exact future of this proceeding in surgical practice. Tuffier has performed over 500 operations, and has never met with any serious complications.

The question of the relative risks of spinal anæsthesia and general anæsthesia by chloroform or ether cannot as yet be definitely answered. This method cannot, however, in any way be expected to supersede general anæsthesia. In many operations, loss of consciousness is as desirable as analgesia; and also, under cocaine narcosis, complete muscular relaxation, so necessary in many abdominal operations, is not obtained in every case.

Spinal anæsthesia is, moreover, only suitable for operations on the lower half of the body, and although attempts have been made to induce anæsthesia by injections in the dorsal or cervical regions, these cannot be considered as in any way desirable, and may be dangerous.

This method is not suitable for children, or for nervous or hysterical patients, nor for prolonged and difficult abdominal operations (Tuffier). In abdominal work, one of the drawbacks of this method is that nausea, or even sickness, may occur during the operation.

Bier, of Kiel, the originator of this method, maintains a cautious attitude with regard to it, and has recently sounded a note of warning against its general use. He says that, whilst it presents certain obvious advantages over general anæsthesia, the technique is not as yet sufficiently perfected to warrant the enthusiasm with which it has been accepted by some surgeons. He strongly urges further trials with the object of rendering the procedure quite free from all drawbacks and risks.

It is evident that the toxic effect of cocaine in certain individuals is still the principal element of danger. Eucaine and β-eucaine have been used, but the anæsthetic effect is very feeble in small doses, and in some cases the injection has entirely failed. Antipyrin has also been used with partial success. It is possible that a non-toxic anæsthetic agent will be discovered, which would be of great advantage. Tropacocaine has recently been used with success, and is said to be devoid of all toxic effects (*vide* Schwartz, *Centralbl. fur Chirurgie*, March, 1901; also Neugebauer, *Wiener klin. Wchnschr.*, 1901, No. 50, p. 1229).

The loss of cerebro-spinal fluid is also a complication to be avoided, and recently attempts have been successfully made to use the cerebro-spinal fluid as a vehicle for the injection of the cocaine solution, and in this way it may be anticipated that the symptoms, arising possibly from alterations of cerebro-spinal pressure, may be avoided.[8]

The indications and contra-indications for the adoption of spinal anæsthesia in any given case cannot as yet be clearly defined; indeed, we appear to be at a period analagous to that which existed on the introduction of chloroform and ether as general anæsthetics. In patients suffering from lung disorders, such as bronchitis and emphysema, when there is increased risk in giving chloroform or ether, this method may be used with advantage, as also, probably, in cases of albuminuria, though this is not so certain.

Further experience is required before a final estimate of the true position of this method of anæsthesia can be obtained; but I believe that further knowledge will justify us in continuing to use this method in selected cases, and that a definite advance has been made in the marvellous history of anæsthesia.

8. Guenard, *La Semaine Médicale*, Oct. 23, 1901.

## ANALYSIS OF 18 CASES OF MEDULLARY NARCOSIS BY COCAINE INJECTION.

| No. | Age. | Nature of Disease. | Operation. | Condition during operation. | After Effects. | | | Subsequent Course. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Sickness. | Pyrexia. | Headache. | |
| 1 | 28 | Endometritis. Hæmorrhoids. | Curetting. Ligature of hæmorrhoids. | Quite comfortable. | ——— | Temp. 101·5° same evening. | For 24 hours moderate. | Normal. |
| 2 | 37 | Pelvic abscess. | Vaginal section. Drainage. | Slight cramp in legs. Face flushed. | ——— | ——— | Moderate for 12 hours. | Normal. |
| 3 | 35 | Acute pelvic peritonitis. Pyosalpinx. Temp. 101°, 103° before operation. | Vaginal section. Drainage. | Quite comfortable. Slight nausea. | Severe for 2-3 days. | Temp. 102° same evening, then rapid fall to normal. | Moderate. | Normal. |
| 4 | 33 | Pregnancy four months, with fibro-myoma in pelvis. Lipoma of labium. | Abdominal section. Elevation of tumour. Removal of lipoma. | No discomfort during abdominal section. Patient complained of pain during removal of lipoma, and a small quantity of chloroform was administered. | ——— | Temp. 99·6° same evening. | Slight. | Normal. |
| 5 | 44 | Recurrent uterine hæmorrhage. Chronic metritis. | Exploration of uterus. Ligature of right uterine artery. | Patient had some pain during operation; also nausea. Face pale. | ——— | ——— | ——— | Normal. |
| 6 | 28 | Hæmorrhoids. | Excision. | Patient felt faint and had some nausea. | Slight. | Temp. 102° same evening. | Severe for 24 hours. | Normal. |
| 7 | 49 | Ovarian cyst. Twist of pedicle. Bronchitis. Cardiac dilatation. Temp. 101-101·8° | Ovariotomy. | Quite comfortable during operation. | No sickness. | ——— | ——— | Normal. Temp. fell to normal after operation. |
| 8 | 37 | Hypertrophy of cervix. Prolapsus uteri. | Amputation of cervix. Posterior colporraphy. | Patient quite easy during operation. | Slight sickness. | Temp. 103·8° same evening. Then rapid fall to normal. | Severe headache 24 hours. | Normal. |
| 9 | 28 | Endometritis. Vaginismus. | Curettage. Excision of hymen. | Patient had cramp in legs during operation. Face flushed. | Slight sickness 24 hours. | Temp. 101° same evening. | Headache 4 days. | Normal. |
| 10 | 34 | Ovarian Tumour. | Ovariotomy. | Patient quite comfortable. No sickness. | ——— | ——— | Slight 12 hours. | Normal |
| 11 | 32 | Pregnancy with pelvic deformity | Cæsarean section (operation performed by Prof. Sinclair). | Patient sick before operation. Face flushed. Some thirst. | Moderate sickness for 12 hours. | Temp. 101° same evening. | Severe for 2 days. | Tympanites and sickness 3rd day. Good recovery. |
| 12 | 40 | Retroflexion of uterus. Cystic ovaries. | Ventrofixation. Resection of ovaries. | Some nausea and slight sickness during operation. | Slight for 12 hours. | Temp. 100·6° | Occipital headache 12 hours. | Normal. |
| 13 | 32 | Complete rupture of perineum. | Restoration of perineum. | Very comfortable during operation. | ——— | Temp. 99·8° | Severe occipital for 24 hours. | Had urticaria 6th day. |
| 14 | 33 | Hæmorrhoids. | Excision. | No discomfort. | ——— | ——— | ——— | Normal |
| 15 | 24 | Tubo-ovarian tumour. Ovarian abscess | Abdominal section. Removal of left ovary. | Slight sickness twice during operation. Face pale. | None till 3rd day. | ——— | ——— | Normal. |
| 16 | 36 | Endometritis (Malignant?) | Exploration. Curettage | Quite easy during operation. Feeling of faintness afterwards. | ——— | ——— | ——— | Normal. |
| 17 | 32 | Tubo-Ovarian Tumour. Pelvic Peritonitis. | Abdominal section. Removal of left appendages. | Quite easy. Slight straining twice during operation. | ——— | Temp. 100·4° same evening. | Slight for 12 hours. | Normal. |
| 18 | 31 | Ovarian tumour. | Ovariotomy. | Anæsthesia not successful.* Chloroform given | ——— | Temp. 100° same evening. | ——— | Normal. |

* In this case blood escaped through the puncture, and the injection evidently did not enter the sub-arachnoid space.