On the safety and suitableness of chloroform as an anaesthetic agent in some of the more complex and serious operations in surgery : with illustrative cases and remarks on lithotrity, and on the lateral and high operations of lithotomy / by William Keith.

ON

THE SAFETY AND SUITABLENESS OF CHLOROFORM

AS

AN ANÆSTHETIC AGENT IN SOME OF THE MORE COMPLEX AND SERIOUS OPERATIONS IN SURGERY;

WITH

ILLUSTRATIVE CASES AND REMARKS ON LITHOTRITY, AND ON THE LATERAL AND HIGH OPERATIONS OF LITHOTOMY.

BY

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ON CHLOROFORM

IN THE

SEVERER OPERATIONS IN SURGERY.

ETHER had been tried very fairly at the Aberdeen Infirmary without affording the satisfaction which many professed to derive from its use by inhalation, and without obtaining the confidence of the medical officers sufficiently to induce them to continue to employ it; so that when Dr Simpson's "Account of a new Anæsthetic Agent as a Substitute for Sulphuric Ether in Surgery and Midwifery" was published, ether had by them been wholly laid aside. The new agent, *chloroform*, was speedily subjected to a similar trial, and the issue is unquestionably most triumphant. It has been used in all the ordinary operations of surgery, in amputations, excision of tumors, reduction of dislocations, &c., with the happiest effect, and without one attendant drawback. It has been employed at all ages with equal immunity from danger. On the 29th January, 1848, I subjected an infant aged four months to its influence, while the painful process of subcutaneous ligature of a large nœvus on the head was undergone, and that without a movement on the child's part, and with entire safety. But in two cases of lithotomy, violent convulsive struggling came on after the patients were secured for operation, which not only deterred the writer himself, but led him to discourage others from using chloroform in like cases.

Having, however, very recently enjoyed the advantage of being present while Professors Simpson, Syme, and Miller operated on various patients in a state of anæsthesia, and having been privileged to hear Professor Miller's admirable lecture "On the Surgical Experience of Chloroform," introductory to his course for the present session (1848), and which he has since published, it became quite apparent that the mode of administration, and not the chloroform, had been in fault in the two cases above referred to. Four cases of stone having offered

immediately on the writer's return to Aberdeen, each was subjected to the operation best suited to the case, and all to the anæsthetic influence of chloroform, and that with effects so entirely satisfactory, that he feels in fairness bound to make the issue of the trial known, with the view of abating prejudice, and of at least removing such doubts as he himself may have helped to create.

Not to weaken the evidence of their authenticity, the cases are given in detail; but it is trusted that the interest attaching to a class of cases, at all times so seriously involving life, will hinder the communication from seeming tedious.

Case of Stone in the Bladder treated by Lithotrity, the Patient being at the time under the Anæsthetic influence of Chloroform.

November 14, 1848. John Smith, farmer, aged fifty-six, from the parish of Glenbucket, admitted, labouring under the usual symptoms of stone in the bladder, which had continued without remission for a period of sixteen weeks; at the commencement of which the symptoms suddenly supervened after an attack of severe pain in one of his loins. States that he had suffered in a similar manner several times, and had on each occasion subsequently passed a calculus by the urethra of an oblong shape, one of which weighing twelve grains, and composed of lithic acid, he produced; but that he had been exempt from such for a period of five years prior to the present attack.

Nov. 15. Chloroform was administered freely. After a struggle of half a minute's duration, requiring his limbs to be steadied by four assistants, and then a good humoured indulgence in a display of celtic eloquence, which lasted five minutes, he went into a state of complete anæsthesia, breathing deeply, but without stertor. When in this state, the bladder was explored, and a stone of small size readily detected—the operation of sounding being much facilitated by the absence of any tightening at the neck of the bladder around the instrument, the sphincter having been rendered entirely passive.

Nov. 17. The bowels having been cleared out by a dose of castor-oil, and having retained his urine for two hours, he was at 10 A.M. put under the influence of chloroform. The same scene, though of shorter duration, was again enacted—the sleep ensuing calm, easy, and profound.

The screw lithotrite was introduced, the stone immediately seized, and crushed, and four fragments subsequently picked up and reduced to powder. The lithotrite was then withdrawn, and the screw scoop twice passed into the bladder, and each time brought out having its jaws filled with debris (sand and gravel). The operation, from the introduction of the lithotrite, occupied two minutes and a half. The sphincter of the bladder was quite relaxed during the whole proceeding, but the bladder was itself so active that the urine had to be restrained by the thumb and finger of the left hand, embracing the penis and shaft of the instrument.

This patient, during the operation, was still as a sleeping child, manifesting no signs of suffering, but in a degree conscious of the presence of the operator and students, and even capable of replying intelligently to a question put to another, which he had understood as addressed to him.

This patient never had the slightest bad symptom. For two days after the operation, he passed with his urine a large quantity of sand and fragments. On the fourth day after, he returned home a distance of fifty-seven miles.

Case of Stone in the Bladder in a Child on whom the Lateral Operation of Lithotomy was performed while under the Anæsthetic influence of Chloroform.

November 3, 1848.—Alexander Donald, aged three, a fine healthy-looking child, was admitted, presenting the following symptoms:—Unable to retain

his water for any length of time; agonizing pain after making it; sudden stoppages occurring during its flow; urine scanty, and high-coloured.

His mother states that he had fever when a year old; since which he never has been well or free from suffering, often passing gravel with his urine, and having great pain in so doing.

November 6.—He was put under the influence of chloroform, and that with the greatest facility, one drachm of chloroform setting him soundly asleep in one minute. On proceeding to sound him, a congenital phymosis was detected, the aperture exceedingly small. Circumcision was, therefore, at once performed, and the glans penis fairly exposed by peeling back the adherent remains of prepuce saved—an operation usually attended by considerable pain. The stone was felt, but the final sounding delayed until November 8, when again, under chloroform, the operation of sounding was conducted with an ease, comfort, and precision, that such an agent could alone secure. A stone, of small size, was readily detected.

November 25.—Having been brought fully under the influence of chloroform, while in his own bed, he was then carried to the operating theatre, held in the proper position by two assistants, and cut by the lateral mode. After some little delay, occasioned by the situation of the calculus behind the pubis, and its small size (weighing ten grains), it was extracted; a small tube introduced by the wound into the bladder, and the little patient, still sleeping soundly, conveyed to his bed. The whole proceeding occupied eight minutes. During the whole time, from his removal till his return to bed, he lay quite still, and wholly exempt from suffering; and awoke about an hour afterwards contented and happy, and to all appearance unaware of anything extraordinary having happened to him.

This little patient progressed in the most favourable manner, and was dismissed cured on the nineteenth day after the operation.

Case of Stone in the Bladder of an Adult in whom the Lateral Operation of Lithotomy was performed, while under the Anæsthetic influence of Chloroform.

November 14, 1848.—Alexander Beattie, aged forty-six, farmer, was admitted with all the usual symptoms of stone; was sounded, and a stone of some size, at once detected. States that, about a year and a half ago, he suffered from severe pains in his left lumbar region, the pains extending towards the symphisis pubis, attended by scalding heat along the urethra when voiding urine; that he had ever since had irritation about the bladder, occasionally passing gravel; was sounded by Dr Milne of Banff, eight months since, who found a stone, and urged the propriety of his submitting to lithotomy. In compliance with his advice, he presented at the hospital soon after; but his health being at the time feeble, his urine loaded with phosphates and slightly albuminous, he was put under a suitable course of treatment, and sent home until his health should be re-established. After an absence of nearly three months, he returned on the 14th November much improved in appearance, though still very spare of flesh. Urine light brown in colour, specific gravity 1017, free of deposit, whether treated by heat or by nitric acid, and neutral when tested by litmus paper. His appetite good, his pulse natural, and he sleeps well, his bladder being at present comparatively quiet.

November 25.—Having, by order, retained his water for half an hour, he was, while still in his bed, put under the influence of chloroform. This, though the first trial of that agent in his case, was accomplished with great ease and rapidity, simply by its copious administration (the handkerchief being well saturated with a pure chloroform). He was carried asleep to the theatre, the staff was introduced, and the limbs secured. While this was being accomplished, the stomach first and then the lower gut were emptied with considerable force, without awakening him or occasioning interruption to any one: Dr Pirrie, who was assisting at the time, remarked, however, that at the same moment the bladder was contracting spasmodically, and would, but for the

restraining pressure of his finger on the penis, have discharged its contents also. The incision was then made, the forceps introduced, a stone (weighing seven drachms) extracted, a tube inserted into the bladder, and the patient carried, still sound asleep, to bed; the whole operation having occupied two minutes. He slept for half an hour after, and on awaking expressed much gratification at finding the business over.

This patient made a good recovery, and, about a month after the operation, returned home to a distance in the country.

Case of Stone in the Bladder of an Adult in whom the High Operation of Lithotomy was performed while under the Anæsthetic influence of Chloroform.

October 31, 1848.—James Duncan, aged sixty-seven, saddler, admitted complaining of frequent calls to make water—of great pain along the urethra and beneath the glans penis, after voiding it—of the irritation being greatly augmented, and the urine tinged with blood after any exertion. Health in general good. Had no idea of stone being in his bladder. States that eleven years ago he was suddenly seized with pain in the region of the left kidney extending to the groin—was ill for a fortnight, and then gradually recovered. Three years since had a very similar attack in the same side, and from this period he dates the appearance of bloody urine on making any extraordinary exertion. He was subjected to chloroform to try its effects upon him preparatory to any operation; he struggled convulsively for three minutes, but when fully overcome lay perfectly still while being sounded, and for ten minutes after. Two stones of large size were in his bladder—so large as at once to suggest the propriety of extracting them above the pubis in place of risking the bruising of soft parts in attempting their extraction by the lateral mode. The urine was clear, free of sediment or deposit with heat or acid—reaction alkaline, sp. gr. 1017. Bladder dilatable by injection, and all the natural functions well performed for a man at sixty-seven. Pulse seventy-eight—full but soft. Tongue clean but tremulous.

November 25, Saturday, Eleven A.M.—The bowels having been well cleared out by castor oil and by injection, he was put under the influence of chloroform in bed, and that in half the time required on two former occasions on which its effects had been tried, and without a struggle. He was then carried to the operating table—laid on his back—the nates elevated—the lower limbs bent over the end of the table, and the knees secured by tapes to the legs of the table.

The urine in the bladder was allowed to escape through the injecting catheter, and the bladder then filled to distension with thin barley water, by means of a syringe—the attempt was made to throw in twelve ounces, but such was the resistance of the bladder, that the operation was proceeded with, only six ounces being retained, and that by restraint. An incision was made between the recti and pyramidales muscles, from a point about mid-way between the umbilicus and symphisis pubis to very near the root of the penis. The finger sufficed to separate these muscles—the abdominal fascia was scratched through, and the bladder reached; the duplicature of the peritoneum was very visible at the upper angle of the wound; it was pressed upwards and supported by the finger of the surgeon assisting; the wound was then extended upwards, the finger acting as a shield and directory to the knife until the recti muscles were separated nearly as high up as the commencement of the incision in the skin. The wound at the lower end was tight and insufficient until the tendinous connexion of both the pyramidal muscles with the pubis was cut through, when the freest possible access was then had to the bladder. The bladder was then seized with a spring or bull-dog forceps immediately behind the symphisis pubis, lifted up thereby, and a bistoury pointed downwards thrust through its coats. A finger promptly introduced hindered collapse of the bladder, and served as a guide to the knife in enlarging the wound in the bladder, a little way upward, but much more down towards the neck of the bladder. Before

withdrawing the finger a blunt hook was inserted and held by the assistant, so as to keep the wound patent and support the fundus of the bladder. Indeed, of so much importance was it deemed to prevent the possibility of the bladder falling down by collapsing into the pelvis, that the spring forceps allowed to retain its original hold, was confided, along with the blunt hook, to the assistant, and the means proved admirably suited. The forceps were then introduced, and in succession two stones of large size, each weighing two ounces, were extracted with extreme facility. A curved silver tube, with a shield at its outer end was inserted at the lower angle of the wound, the edges of which were then neatly closed by three stitches and isinglass plaster. Another tube with a sigmoid flexure was inserted per urethram, and both secured by an abdominal belt and perineal band. The whole operative procedure occupied six minutes, during which the patient slept soundly, and never moved a muscle. He was carried to bed, and continued to dose on with only sufficient interruption to enable him to take a drink, until 2 P.M., when he wakened up, and described the ease and comfort with which he went under the influence of the chloroform, and the entire absence of sensation, mental or corporeal, ever since the hour of eleven.

Eight P.M.—Has slept with little intermission. Feels easy. Pulse 76. Urine clear, and flowing freely by the suprapubic tube ; the other tube appearing to serve no good purpose is withdrawn, and the abdominal belt with the perineal band also laid aside. The wound neatly closed between the stitches with isinglass plaster, painted over with collodion, and a small square of oil-silk, with the tube-shield protruded through a slit in its centre, made to cover the whole, and convey the urine clear away from the abdomen.

November 26, Ten A.M.—Has slept well—urine copious. Pulse 80, soft. Skin and tongue both moist. The abdomen soft, easy, and in no degree tumid. The dressings guarded by the oiled silk are completely protected from moisture, and the skin all around sheathed by repeated smearings with lard. The urine finds a free and constant escape by the tube above the pubis.

Nov. 28, 7 A.M.—Continues to do well. Slept soundly all night ; pulse 88 ; tongue slightly furred, but moist ; bowels have not moved. To have half an ounce of castor oil for the second time ; urine copious. 10 A.M.—Removed the stitches from the wound ; union complete up to the tube : reapplied isinglass plaster. 2 P.M.—Belly rather tumid, but no complaint made on pressure being applied ; a purgative enema administered. 6 P.M.—The enema repeated. 9 P.M.—Bowels not relieved ; belly more tense ; admits now that there is some pain on pressure ; pulse 120, full and hard ; skin soft, but the tongue dry ; urine quite copious and limpid, distilling incessantly from the tube ; the tube removed ; bled to sixteen ounces ; repeat the enemata ; give five grains of calomel immediately, and one grain every hour after ; strong mercurial ointment to be rubbed perseveringly into his thighs. A warm cataplasm applied over the abdomen, to be renewed every two hours. 10 P.M.—The lower guts emptied by the enemata ; the belly felt somewhat relaxed. Pergat. 11 P.M.—Blood drawn at 9, very thickly buffed ; says he feels easy : the expression of his countenance is anxious ; breathing hurried ; pulse 130.

He continued the remedies until 4 A.M., his breathing becoming more and more hurried. At 5 A.M., on the 29th November, he expired.

At 11 A.M., the same day, an inspection was made. The abdomen appeared full, but neither tense nor much distended. The lips of the wound were easily separated ; the tract of the wound downwards to the bladder was brown looking, showing a few scattered points of commencing granulation. The duplicature of peritoneum lay entire in a loose fold, at the upper angle of the wound. A semicircular incision, passing from the crest of one ilium to the crest of the other, and above the umbilicus, afforded a flap, which, when thrown down over the pubis, allowed the viscera to come into full view. The intestines were distended by flatus ; slight traces of congestion were noticed, and it was thought that their peritoneal coat did not present its usual glossy appearance. There

was no agglutination of the intestines or other viscera to each other, nor any effusion of the usual products of inflammation, neither serum, lymph, or pus. The peritoneum lining the abdominal wall, and passing on to the fundus of the bladder, was then subjected to the most searching examination. The whole was healthy, glossy, and entire. The duplicature, stretched on the points of three fingers inserted at the wound, enabled all present to see, and be satisfied on these points.

On lifting up the intestines and looking down into the pelvis, the peritoneum, where it passes from the fundus of the bladder to the rectum, seemed thickened and whitened, as if from some effusion on its vesical side. The bladder was carefully detached from the pubis, and along with the surrounding parts, removed, when it became apparent that the cellular tissue in front of, and around the neck of the bladder, was loaded by infiltration with a plastic pus-like fluid. The same it was that gave the colour and thickened appearance to the peritoneum behind it. The pus was not collected in quantity, but evidently occupied the cells of the loose tissue around the neck of the bladder. It penetrated so low as to envelope the prostate gland on the left side, and on the same side permeated the tissue connecting the peritoneal and muscular coats of the bladder some way backwards. The fluid above alluded to, viewed through the microscope, was seen to contain the primitive filaments described by Bennett, and among these were numerous pyoid corpuscles, some of which bore a considerable resemblance to impure pus globules. The bladder was itself healthy, of course much contracted; the wound occupied the mesial line; measured an inch and a half in length; and extended from a point half an inch below where the peritoneum takes hold of the fundus, down to within one inch of the neck of the bladder.

From the above record it is therefore apparent, that death resulted from imbibition or infiltration of urine through the vesical wound into the cellular tissue around and below the neck of the bladder; and, humanly speaking, might have been prevented by the use of a lithotomy tube inserted into the bladder through a perineal wound. The syphon tube in the urethra completely disappointed expectation; and the suprapubic tube, though it answered admirably as a safety valve, was insufficient to secure the entire escape of the urinary secretion.

If asked why the high operation was in this last case selected, the reply would be:—Owing to the large size of the stones which had to be removed,—an element so influential on the results of the lateral operation for evil, that means must be devised for lessening the mortality after that operation, where the calculi come to exceed two ounces in weight.

Dr Simpson, in the Monthly Journal of Medical Science for November 1847, sets this matter in the strongest possible light, by the following table, composed from the data of Mr Crosse. It exhibits the mortality of lithotomy, calculated according to the different weights of the stone extracted:—

Weight of Stone.	No. of Cases.	No. of Deaths.	Ratio of Mortality.	Per Centage Mortality.
2 oz. and under.	648	65	1 in $9\frac{63}{65}$	10 in 100
From 2 to 4 oz.	46	23	1 in 2	50 in 100
From 4 to 7 oz.	9	5	1 in $1\frac{4}{5}$	55 in 100

In an experience, now extending over eighty-three cases of lithotomy, including hospital and private practice, the writer has arrived at results very strikingly similar. In fourteen cases, the weight of the stone ranged from two ounces up to four ounces; of these seven recovered, and the large proportion of seven died.[1] It need not, therefore, excite wonder, that while he seeks to recommend the adoption of Lithotrity for all stones weighing less than half an ounce, and the continuance of Lateral Lithotomy for all stones weighing less than two ounces, he should desire the revival of a mode of operating for the removal of such as are larger still, in which the soft parts escape bruising, and bulk in the stone ceases to be the same source of danger, because in the high operation the outlet is not *confined* by a solid arch of bone.—But, to return from this degression.

In the first case—where Lithotrity was performed, the influence exercised by the chloroform was altogether beneficial. Usually the sphincter of the bladder is so tightened by the patient's fears and struggles, that the movements of the instrument are very much impeded, the delicacy of touch, needful in detecting small fragments, quite destroyed, and a painful resistance offered to the withdrawal of the instrument, especially if that chance to be a scoop well filled with the debris of the broken stone. But under chloroform fears are at rest, the bladder insensible, and the sphincter quite relaxed. In such a case the operator has only to curb his own zeal, and, remembering that he is operating on a living being, suspend his manipulations before he has inflicted so much mechanical injury, as to excite after action in the vessels of the mucous membrane of the bladder.

Without chloroform, the straining is usually so great during the operation, that with every available means of restraint, much of the urine escapes by the sides of the lithotrite; and often, in consequence of the bladder thus becoming emptied, the operation is prematurely closed for the time. Under chloroform it was not

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[1] Lest the fact above stated should lead to a wrong estimate of the proportion in which large stones may be expected to occur in practice, it may be proper to state, that while these eighty-three cases offered for lithotomy, there were sixty-eight operated on by lithotrity, in which the stones averaged only two and a half drachms; and further, fourteen cases were refused as unfit, from age and decrepitude, in which the stones were all large.

The statistics of the writer's experience at this date, therefore, are—

68	stones under ½ oz.,	removed by	Lithotrity.
69	do. do. 2 oz.,	do.	by Lithotomy.
14	do. from 2 oz. to 4 oz.		do.
14	do. do.	do.	unfit for any operation.
165			

giving of cases that offer with stones above 2 oz. in weight 1 in $5\frac{2}{28}$, and of such in which operative interference may be thought of, 1 in $11\frac{11}{14}$, so that in every twelve cases of stone that occur, five may be cured by lithotrity, five by lateral lithotomy, one by the high operation, and one rejected as unfit.

found so difficult to restrain the flow; but even were the bladder emptied, as there would be neither suffering nor resistance by the patient, the bladder could be again filled by injection with great ease, and the operation resumed. Usually, from the loss of consent between those parts necessary for the successful accomplishment of the effort, urine cannot be made for some hours after the operation, and accumulates so much to the discomfort of the patient, as often to require the catheter,—doubtless, owing to the painful stretching and struggle of parts connected with that important function. Under chloroform, the bladder is seen to contract itself promptly and completely, and continues to do so afterwards. It ought at the same time to be noted, that this active state of the bladder is in its way no less useful than is the passive state of the sphincter, in as far as, by keeping the bladder tense around its fluid contents, no loose folds can exist for fragments to lodge between.

In the second case,—that of the child subjected to lithotomy,—the operation was more than usually prolonged. Had it not been for chloroform, the struggles of the child might have added to the difficulties, and the shock to the constitution would have been proportionably severe. As it was, the child lay without a movement, slept without once awaking, and made an uninterrupted, a rapid, and a perfect recovery, having been dismissed cured on the eighteenth day thereafter,—the child's reminiscence of the whole proceeding being, that "the doctor gave him snuff, and took away his stone."

The observation made on these two cases, and the experience acquired, will induce the writer now to practise lithotrity on children also, an operation which he never did deem safe for them previous to the introduction of the use of chloroform.

In the third case,—another of lithotomy,—the whole proceeding occupied so brief a space, that there was little time to make observations. The emptying of the stomach, noticed so invariably if food has been taken recently, should induce attention to the precaution of making every patient fast for two hours at least before having chloroform administered. The quiescence during the operation was absolute; the comfort to the patient every thing that a total insensibility could secure; the recovery since was steady and progressive.

In the fourth case,—where the high operation was performed,—the comfort to the patient from the use of the anæsthetic agent, was immense, and little less so to the surgeon. The whole presented the semblance of a clean, calm, nice dissection; the patient suffering as little pain, and the surgeon as little interruption, as if what was realised had been only semblance. The favourable progress of the case for so many days after the operation, demonstrates the fact, that death did not result from any thing immediately connected with the operation itself. The infiltration of urine is supposed to have taken place on the night between Monday and Tuesday, when, being tired lying on his back, he turned on his left side, and

dislodged the tube for a time. Clearly, in another case, a more secure and efficient mode of exit for the urine must be ensured.

The chloroform used in these cases was very excellent and pure. It was prepared by Mr Robert Rattray, practical chemist, who manufactures it largely in Aberdeen, being apothecary to the hospital. It was by him also very efficiently administered, and its effects watched. The quantity consumed by the child was about two drachms; by each of the adults from six drachms to an ounce. The effect produced being more noticed than the measure as to quantity; the leading lights, in truth, being those two indicated by Professor Miller (see page 20th) in his published lecture,—"first, to make sure of a pure chloroform; and, second, when struggling commences, not to desist, but to go on with an increase of dose." The work just quoted from has so ably and so completely exhausted the subject of the "Surgical Experience of Chloroform,'' anticipating every conclusion that could be drawn in connexion with chloroform from the few preceding cases, that the writer, now they are finished, feels extreme diffidence in forwarding them to the Medico-Chirurgical Society. He does so in the belief, that his brethren in the provinces will feel much encouraged by the successful example of one of their own number; and in the hope that at a distance, *e. g.*, in our sister isle, where evidence emanating from the Scottish metropolis obtains credence with great difficulty, the testimony of an humble provincial may be more favourably received when he declares, after a patient and dispassionate trial, that chloroform, as an anæsthetic agent, is suitable, safe, and effectual in the severest operations in surgery.

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