excision of the knee, it is especially important to prevent bleeding from the various small arteries that are divided; for, unless this be carefully done, blood will collect in the wound, between and behind the bones, after the patient is in bed, will lead to suppuration, and be a source of much trouble. To prevent this evil, I sometimes found it necessary to tie several vessels; and the presence of these ligatures with the portions of tissue strangulated by them was certainly a disadvantage. In the last two cases in which I have performed this operation, I have gladly availed myself of torsion of the arteries, and have been well satisfied with the result. Still, a greater number of cases of this and other operations are necessary, to test properly the value of this mode of closing the arteries. The plan which I adopt is, as you are aware, for the smaller arteries, to use a pair of clasp-forceps, which, at the end, are rather broad, and provided with fine interlocking blunted teeth, by means of which the artery is held securely during the twisting. This I continue till the coats are quite torn through, and the forceps are thereby set free. In the case of the larger arteries, I found, by experiment on the dead body, that these forceps divided the coats of the vessel, and tore their way out too quickly; so that, when I injected water into the artery by a syringe it soon, under very slight force, separated and obliterated the folds of the inner coat, which had been caused by the torsion, made its way under the outer coat, and burst through that coat. I tried other forceps of different shapes, and found that the pair of strong narrow-bladed hinge-forceps, which I show you, and which I have been in the habit of using to extract bone in operations for necrosis, answered the purpose better than any others that I have yet used. They resemble somewhat strong dressing-forceps; but the handles are large, giving good purchase, the blades meet closely, and the transverse ridges and furrows near the ends are well adapted, so that they hold the end of the artery tightly without tearing it. You see when I seize with these forceps the end of this femoral artery which I took from a subject yesterday, hold it tightly and twist it, that, although the forceps are not sufficiently broad to cover and embrace the whole diameter of the artery, yet they hold it firmly and retain their hold till the entire end of the vessel has been twisted off. The remaining part presents a conical twisted end, which unfurls itself to some extent, but not entirely, and remains completely closed. I now throw water into it; and not till I have used considerable force do the compressed folds of the inner coat yield, separate, and permit the water to pass beneath the outer coat, which again is so sealed by the twisting, and so strong, though thin, that it offers considerable resistance before it gives way—a resistance much greater than would be required to withstand the pressure of the blood in the living artery. I twist other portions of artery in the same manner. They are all firmly closed. Cutting them open, we find the inner coat more or less lacerated and contused, its surfaces squeezed together and thrown into folds, and held in close contact by the twisted outer coat, which forms coils, terminating in a cone or point at some distance beyond the termination of the inner coat. In some instances, I have found the inner coat detached from the outer by the squeezing that occurs during torsion, and more or less reflected into the artery so as to present its divided edge to the blood-current.

You will, from this explanation and these experiments upon portions of artery (and I have made several observations upon the dead body corresponding with these), understand what takes place when an artery is twisted. The inner thick, elastic coat is thrown into folds, which are crushed or squeezed together so as to block up the channel of the artery; it then gives way, and is torn through, and is held in its position by the outer coat, which resists longer, and undergoes still further twisting and squeezing together of its structures, so that when it is finally torn through, it retains its twisted condition, and continues to exert pressure upon and give support to the inner coat.

I have just had an opportunity of examining a popliteal artery which was twisted in a young man after amputation six weeks ago. It was perfectly closed, was contracted, and surrounded by toughish structure for some little distance. Its internal coat was wrinkled near the end, and showed some traces of ecchymosis.

You have probably observed that the attention to the blood-vessels after operations has occupied rather more time than it did when we used the ligature; and torsion has certainly, in my hands, proved somewhat more difficult than the ligature, requiring more care, more patience, and more perseverance. It is necessary to include the vessel itself in the forceps; for it is useless to twist the surrounding tissues; and it is not always easy, when blood is flowing, to make sure of the exact point from which it flows. Often, therefore, when I have been twisting, I found that my efforts were of no avail, because I had not seized the exact orifice of the vessel. Even when the vessel is seized, the inner coat is liable to slip from between the blades of the forceps, the outer coat only being retained and subjected to the torsion; and this is not to

be relied on. When, however, I have been sure of having seized an artery and properly twisted it, I have not known any further bleeding to take place from it; and if it be carefully done, torsion is, I think, a valuable means of securing small and medium-sized arteries, such as the tibials, facials, etc., and by reducing the number of ligature-threads, it will be found to promote early healing of wounds. Whether it will prove to deserve our confidence in the case of the larger arteries, I am not so sure; but I should say that the doubt is founded rather upon what I have found in experimenting upon the dead subject than on what I have observed in the living; and it may be that better appliances and more experience may justify a greater reliance upon its efficiency. The experiments which I have shown you to-day upon pieces of artery, and those which some of you have seen me make upon the dead body, have proved to you that much care is needed in the selection of proper forceps, and in so seizing and holding the end of the vessel that its inner coat does not slip from between the blades during the twisting; and it will have occurred to you that in the living subject it is not easy to make sure of doing this as it should be done, or to feel certain in any instance that the artery has been properly twisted. The only rule I can lay down is to use all care in the process, especially in grasping the orifice of the artery, and to examine well the remaining torn end after the forceps have been set free by the torsion, so as to ascertain, if possible, whether the vessel is completely closed.

I do not wish you to go away with the impression that the trials of different modes of preventing hæmorrhage from arteries have been made without due consideration, or that the conducting them has been unattended with anxiety. In the early years of my professional career, I was severely tried by some cases in which bleeding occurred and recurred after operations. These cases produced a deep impression upon me, and made me extremely cautious and careful in securing blood-vessels, particularly in the mode of applying the ligatures, and watchful in sponging the surface and examining the tied vessels before closing the wound; and I would not have been induced to try acupressure or torsion had I not been also strongly impressed with the great importance of using all means to obtain early union of the wounds after operations, or rather, I would say, immediate union of the whole or large part of a wound after an operation. There is no doubt that the success of operations will be increased in proportion as we can attain that result; and the prospect of attaining it must depend a good deal upon the mode in which the vessels are secured; the first desideratum being to prevent bleeding; the second, to do it in such a manner as shall least interfere with the healing process. The ligature effects the first object completely; but is so far open to objection with regard to the second, as to justify the cautious trial whether other modes which promise better as regards the healing process may not be equally effective in stemming the blood-currents from the arteries.

POSTSCRIPT TO "FURTHER OBSERVATIONS ON THE CÆSAREAN SECTION".

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As a postscript to my former observations on the Cæsaean section (*BRITISH MEDICAL JOURNAL*, March 28th, 1868, page 295), I now tabulate two cases which were then omitted, and append a few remarks. These two cases are English. One (97) stands, in the history of this operation, quite unique. There are numerous important points belonging to it; and, although I have analytically brought some of them before my readers, yet the entire case ought to be carefully read and studied, as cited in the *Medical Times and Gazette*, vol. ii, 1865, p. 359.

Mr. T. Spencer Wells commenced his operation solely with the object of removing a large ovarian tumour. Before he had completed it and cut through the pedicle, he found another tumour, which he considered to be the right ovary cystically enlarged. He now passed a trocar into it; and, after withdrawing it, three pints of a bloody fluid escaped through the cannula. The tension being thereby so much lessened, he was now able to see the Fallopian tube passing from the upper part, which at once convinced him that he had punctured the gravid uterus. On the cannula being withdrawn, a soft, spongy, bleeding mass protruded. He now introduced his finger, in order to push this back into the uterus, and also to examine the cavity of this organ, during which its tissue, which was soft and friable, as if it had undergone fatty degeneration, gave way along the middle from the puncture (which was near the

fundus) to the extent of three or four inches towards the neck. By very slight pressure, a quantity of liquor amnii, and also a foetus of five months, escaped. The foregoing circumstances constitute what may be considered the cause or necessity for Cæsarean section. The clear, bold, and unequivocal statement made by Mr. Wells reflects the highest honour upon him; and his conduct throughout in relation to the case affords a noble example of high professional morality.

Rickety distortion of the pelvis was in the other (98) case the obstructing cause to the passage of the infant. The brim measured one inch only in its antero-posterior diameter; the transverse was 4½, and the oblique 4¾ inches.

STATISTICS.—These two cases (one saved, and one lost), added to the nineteen which were tabulated in my last communication, make twenty-one cases. The one (97) added to the four before reported gives five, or 23.80 per cent., saved. The other (98) case, added to the number (fifteen) last registered, gives sixteen, or 79.04 per cent., lost. The two infants (one dead, one alive), added to the nineteen already mentioned, make twenty-one, of which fifteen, or 71.42 per cent., were preserved, and six, or 28.57 per cent., were lost. The one dead, belonging to the woman (Case 97) was dead when forced out from the uterus, and was non-viable, being only at five months.

MATERNAL MORTALITY.—The woman (Case 98) was rickety. She died four days after the operation.

PERITONITIS.—The cause of death in Case 98 was peritonitis. She appeared to progress favourably until the third day, when the disease came on. But it is quite evident that the peritoneum could not have been in a healthy condition previously to the operation; for, as soon as the incision was made through the abdominal parietes, some ounces of serum escaped. The low vital state of this membrane must most assuredly have been greatly damaged by the after-treatment. Dr. Hardin says: "Her chances of recovery were considerably lessened by want of proper care and nourishment."—The woman (Case 97) had a pretty smart attack of peritonitis. It commenced on the second day, and became worse on the third. It was, however, subdued and auspiciously terminated.

HÆMORRHAGE.—Hæmorrhage happened in one case (97). There was, as already mentioned, bleeding from three arteries at the lower part of the lacerated tissue, which was effectually subdued by silk ligatures. Oozing of blood from the placental surface of the uterus continued; but it was checked by the introduction of a piece of ice into the cavity of the uterus, and also by firmly grasping this organ. Mr. Wells passed his finger *per vaginam* and os uteri, in order to make a free passage for the discharge, and thereby prevent its passing into the abdomen. Two hours after the operation, bleeding became rather free; but it was at once checked by a drachm dose of the liquid extract of ergot.

RECOVERY.—The recovery of the woman (Case 97) from such a complication and number of very serious matters affords further and still stronger evidence of the wonderful conservative powers of nature. A careful perusal of the case, as detailed by Mr. Wells, ought to convince the most violent and prejudiced anti-Cæsareanist that this operation ought to be recognised and performed with the same confidence of success as that with which other capital operations are now undertaken.

OPERATION.—Few remarks need be made on this part of the subject. The location of the placenta should, if possible, be ascertained by the stethoscope. In fact, this instrument ought to be carefully employed in all cases in which the abdominal cavity is intended to be laid open, either for the removal of an infant from the uterus, or for the ex-

tirpation of an enlarged ovary. The necessity of observing this rule is most forcibly proved by the results of Case 97. Mr. Wells has kindly informed me that the placenta in his case was situated anteriorly and towards the left side. In the other case (98), the seat of the placenta is not mentioned; but it is presumed that it was on the posterior part of the uterus.

CHLOROFORM.—Chloroform was administered in both the cases. For my opinion upon the influence of this anæsthetic on the uterus, the reader is referred to my two former communications. Vomiting occurred afterwards in both cases. On the question whether the vomiting was a *post hoc* or a *propter hoc*, I again refer my reader to observations already made. Mr. Wells, in his letter to me, states: "I don't think we can judge very well what share chloroform had in the sickness." The incision made in the abdominal parietes was in both cases longitudinal and along the linea alba.

SUTURES.—Both abdominal and uterine sutures were used in each of the cases. In Case 97, Mr. Wells brought the edges of the uterine wound together by an uninterrupted suture of fine silk, one long end of which was passed into the uterine cavity, and out through the os uteri into the vagina. The edges of the uterine wound were accurately adapted by seven or eight points. The other end of the silk was brought through the abdominal walls along with the three ligatures which were applied to the bleeding arteries: and all the ligatures were tied to the clamp, which embraced the ovarian pedicle. It is worthy of remark, that Mr. Wells burnt off by a hot iron a portion of the omentum; and, as there was free bleeding, he afterwards applied three silk ligatures; and, after cutting their ends short, he returned the omentum into the abdomen. The edges of the abdominal wound were adjusted by one superficial and six deep silk sutures. In the other case (98), as "the uterine incision was somewhat serrated, it was deemed advisable to put in a couple of metallic sutures. Several others were put in the abdominal walls." In my former observations, I stated that I had an objection to the use of uterine sutures, as I considered them likely to be injurious. I then mentioned one case of recovery that had taken place in which metallic sutures were applied. We have here another example of recovery. Mr. Wells used the uninterrupted silk suture. He thought that the escape of blood or of the secretion from the uterine cavity into the peritoneal cavity might be one cause of the mortality of the Cæsarean section; and, if so, sutures might be useful. If the reader refer to my former observations (BRITISH MEDICAL JOURNAL, April 4th, p. 321), he will find that I have already adverted to this danger, and referred to a case (95) in which the death from peritonitis was attributed to the passage of the uterine discharges into the peritoneal cavity, which were prevented from flowing *per vaginam* by the closed condition of the os and cervix uteri. Whether uterine sutures should be employed, is a most important question to decide. There are cases of recovery after this operation in which sutures were not used, as well as cases of recovery in which they have been applied. But, as regards the evidence to be obtained on the two sides of the question, it would, I think, preponderate in favour of their non-employment. Notwithstanding this may be so, yet I think the subject demands further consideration. If I used a suture, I should prefer the uninterrupted, put in at long points, and with only one long end passed through the os uteri into the vagina; the other end closely cut off, according to the last opinion of Mr. Wells.

[NOTE.—The reader is requested to insert No. 96 to the last case in the table at p. 323.]

TABLE OF CASES OF CÆSAREAN SECTION. (Continued.)

No	Year.	Name and residence of the patient.	By whom and where the case is related.	Operator.	Cause of the difficulty.	Duration of the labour.	Mother.		Child.		Mother survived.
							Preservd.	Died.	Preservd.	Died.	
97	Aug. 14, 1865.	A married woman, aged 24 years, Samaritan Hospital.	Mr. T. Spencer Wells, <i>Medical Times and Gazette</i> , vol. ii, 1865, p. 359.	Mr. Wells.	No pelvic obstruction, but the operation was performed in consequence of a trocar having been thrust into the gravid uterus, after the removal of a large ovarian tumour, etc.	Labour did not exist; she was about five months pregnant.	P.			D. (When removed.)	She lived.
98	Feb. 25, 1865.	Mrs. H.	Mr. Walter Hardin, <i>Lancet</i> , vol. ii, 1865, p. 369.	Mr. Hardin.	Distortion of the pelvis from rickets. Brim, antero-posterior diameter, one inch.	The liquor amnii had escaped six to seven hours. There were no uterine contractions.		D.	P.		4 days.