

PELVITOMY THROUGH THE PUBIC BONE BY GIGLI'S METHOD

AS AN OPERATION IN OBSTETRICS.

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FREDERIC DAVID SIMPSON, M.B., Ch.B., 1900.



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P A R T I .

I. HISTORY OF THE OPERATION:

The operation of Pelvotomy, though it is the most recent in introduction into the list of important obstetric operations dealing with cases where the pelvis is too small for the head to pass, is nevertheless an old operation. It was first suggested by Sigault in Paris in 1768. The 18th Century had already seen the introduction of two important methods of treatment in obstetrics, whereby in many cases both mother and child could be saved. These were 1st, the publishing by Palfyn in 1723 of a description of the Forceps, for though this instrument had been devised many years earlier, it had never been made public, but kept secret by the Chamberlen family, and it was not till the earlier part of the 18th Century that the truth became public. The second was the induction of premature labour, but the date of the introduction of this is uncertain. Denman states that in 1756 the most eminent London physicians of the day met to consider the operation and what advantages might be derived from it. A case occurred shortly afterward in which it was performed, and being successful, spread

a good impression of the operation. It was performed in Germany in 1804 for the first time, but in France its introduction was very strongly opposed and was in fact never done till 1831 when Stoltz performed it successfully.

These were very important additions to the resources which physicians then had at their command, which consisted in craniotomy, turning, and Caesarian section. These three are all unknown as to their dates of origin, but seem to have extended far back into antiquity.

As the French refused a place to premature labour, their number of obstetric resources for contracted pelves before the introduction of pelvotomy was as follows, Caesarian section, embryotomy, turning, and forceps. Owing to the want of antiseptics, Caesarian section was practically always fatal, so that a pregnant woman with a conjugate of less than 2 inches had a very small chance of surviving: forceps and turning could in suitable cases, extract the child with as small a conjugate as $3\frac{1}{4}$ inches or even 3 inches, if the head was small and the pelvis roomy in the transverse. But in many cases even with larger pelves, if the head was larger than usual, forceps and turning were useless, and embryotomy/

otomy became necessary: also, in cases down to 2 inches, below which there was no alternative to Caesarian section, craniotomy was the only way the patient could be delivered. It was for this reason that turning was so popular a method with the French school, and one in which they acquired such skill. As it can rarely reach, however, below or often as low as 3 inches, craniotomy was very frequently inevitable. It was not considered justifiable even in this country till the end of the 17th Century to perform craniotomy on living children, and much later was this the case in France, where the Roman Church held very strong views upon the subject. This state of things therefore accounted for the enthusiasm with which Sigault's idea of Pelvotomy was received when he suggested it in 1768, and when it was successfully performed for the first time in 1777, on a woman called Souchot.

Sigault's operation consisted in dividing the pelvis through the Symphysis, and for some years, there was no suggestion to do it otherwise. The earliest mention of Pelvotomy other than through the symphysis, is in a book, "Principles of Midwifery and Puerperal Pathology", by John Aitken, teacher of Anatomy, Surgery and Midwifery in Edinburgh and a surgeon/

surgeon to the Royal Infirmary. This book was published in 1784, and in it (p. 84), after discussing the methods of overcoming difficulties in parturition by Pelvitomy by Sigault's method, Embryotomy, Hysterotomy and Gastrotomy, he continues: "Is it not practicable to supersede embryotomy and hysterotomy almost always by a *pelvitomia nova*, viz., four incisions, two reaching to the *ossa pubis* as near the crural vessels as safely may be, so that the one may be distant from the other about four inches, and two corresponding to it and touching the joinings of the *ossa pubis* and *ischiorum*. The bones brought in view by these incisions are divided by the flexible saw without wounding the peritoneum, bladder, or vagina. Thus, the anterior segment of the pelvis becomes movable and yields to the pressure of the child so as to permit delivery. If due attention be paid to the wound, the healing may take place in such sort that sufficient capacity of the pelvis may be preserved." He adds in a footnote that he is "just employed in trying this operation upon brutes", but does not state what the results of his experiments are.

Aitken of Edinburgh, therefore, has the credit of suggesting an extramedian division of the pelvis, but not in the form in which it now promises to supersede/

supersede the Sigaultian method.

Champion of Bar-le-duc, - a town in the Province of Meuse, had a part in the development of the operation early in the 19th Century. Murat relates that Champion was not the first to propose pubiotomy. He says Aitken in 1785 invented a saw for the purpose, later called the chain saw of Joffroy, and a curved knife, which has disappeared from surgery, but gave Galbiati the idea for his knife. (Ann. di Ost. e Gin., 1894, p. 651.) Speaking of Champion in his article on Symphysiotomy in the Dictionnaire des Sciences Medicales 1821, Vol. 54, p. 60, Murat says: "It is sometimes necessary to cut one or other pubic bone. In cases of ankylosis for example, some practitioners, among whom I shall limit myself to name M. le Dr Champion de Bar-le-Duc, think that instead of dividing the pubic symphysis, one should cut and it will generally be preferable to cut to the side of such a joint. In fact, by cutting thus, one avoids the urethra, the bladder, and prolonged groping about to find the cartilage interposed between the pubes. One anticipates the obstacle which ossification of the symphysis presents when it exists; the reunion of the bones is more certain: also, if the pubic bone be divided on that side which corresponds to the parietal eminence, one/

gains some lines more; Aitken has devised a saw which he works from within outwards."

The same idea was taken up by Stoltz of Strassburg. In Lacour's These de Paris 1814 Recherche historique et critique sur la provocation de l'accouchement premature, he says that, "Stoltz has for six years described it in his lectures and proved it on cadavera to be an operation of the easiest and simplest kind. The operation consists in the division of one of the pubes near the symphysis by a chain saw, with or without an incision in the skin. To do this, a small puncture is made at the Mons Veneris, after shaving it at a point corresponding to the pubic crest, either to the right or left of the symphysis. Through this opening is introduced a long needle slightly curved, to which the chain saw is fixed. This needle is made to pass along the posterior aspect of the pubis, close to the bone, and the point is made to emerge at the side of the side of the clitoris between the descending ramus of the pubis and the corresponding corpus cavernosum. The needle carries the saw, to which a handle is fixed. Taking it by the ends, it is stretched lightly between the hands and in a few movements, the bone is cut through. The two ends severed, separate to a distance/

distance at once. This separation may be increased at will and will increase by pressure of the head. The pubis being divided, one of the handles is removed and the saw drawn out, merely leaving a small aperture, which heals with the greatest ease."

On comparing this with the modern method, one sees that the two are practically identical, except that the modern one is done by an open incision. Owing to the absence of the ideas of asepsis and antisepsis, as well as to lack of knowledge of the exact cases in which good results might be confidently expected, the operation does not seem to have received much recognition at the time. These disadvantages have now, however, been overcome, and it has again be brought in to notice by Dr Gigli of Florence, who has devised for its easy performance, a saw of roughened wire, which makes the operation easy and rapid in its execution, and a suitably curved handled needle for the passage of the saw. Dr Gigli published a description of his saw in the *Centralblatt für Chirurgie*, No. 18, 1894, and in the same year, in the *Ann. di Ostet. e Gin.*, p. 649-667, he brought his idea for reviving the old operation of pubiotomy into notice in an article, "Taglio Lateralizzato del Pube suoi vantaggi, sua tecnica." In his most recently/

recently published paper on the subject, in the Bulletin de la Societe d'Obstetrique de Paris, 1903, p. 68, he indicates what considerations induced him to bring forward the new method. "The hope of introducing more largely into practice, the idea of Sigault, and of overcoming the difficulties which experience of late years has shown to be present in the classical technique of symphysiotomy, gave me the idea of looking for a new form of operation. The classical operation does not give very satisfactory results. It has presented, and still presents the same seriousness, and same results as Caesarian Section. In the cliniques and maternity departments of hospitals, Caesarian Section is actually preferred to it. It is where the practice of Caesarian section is done under the difficulty of lack of rigorous asepsis that the application of Sigault's idea should find its natural place. If symphysiotomy has not given practicable results, it is because we have chosen the route most beset with difficulties, and led astray by simplicity in instruments, we have always sought to accomplish the operation with a knife. But in order to operate with this instrument, the hand should be quite sure and experienced in order not to exceed the limits determined/

determined by anatomy, which it is so easy to exceed. Moreover, we are obliged to open the joint cavity of the symphysis - that is to say, we are obliged to produce a surgical trauma much more serious than is necessary to enlarge the pelvis. We are at the same time, obliged to keep to the middle line, where nature has placed a larger number of vessels and very delicate organs. The bleeding is manageable, but always troublesome and serious in symphysiotomy and the explanation of this is easily found in the anatomical arrangement. Outside the median region the haemorrhage is infinitely less. From the surgical point of view, symphysiotomy is an arthrotomy - a joint lesion which is serious and much more grave than a lesion of bone. Moreover, for this obstetric pubic arthrotomy, the conditions in which the surgeon is obliged to operate, are not a point to be despised. The accoucheur is not able to choose his time, and he is never able to be sure of subsequent events in the puerperium. Hence, as a rule, we operate on cases where, from a surgical standpoint, a true contraindication exists; and the proof is clear that it is in this violation of one of the most important laws of surgery, that we ought partly to seek the reasons of the unsatisfactory results/

results that the great number of operators have obtained from symphysiotomy, and the cause of most of the disasters. Now, if we add that it is not possible that the wound of the joint escape contamination by puerperal secretion, that it is impossible to apply a dressing absolutely protective, that it is impossible to immobilise completely the wounded joint, we can well see how it is impossible to have in symphysiotomy the brilliant and sure results which surgery to-day obtains in its interventions on the most important joints. If one considers all the manipulations which stripping off the retro-pubic tissue involves, and the ease of lacerations, one will understand the difficulties in the way of a simple and complete cure.

After seeing many operations in Germany and Paris during 1892-3 in the profound conviction that the operative gravity of symphysiotomy is given by its technique and by its violation of the laws of joint surgery, I sought to avoid all these dangers and saw it was necessary to operate outside the middle line, finding to be wise, the advice which Champion de Bar-le-Duc, gave in the beginning of the 19th Century, and which Stoltz found so simple and so easy to execute.

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But among surgical instruments, there was not one capable of giving me the means to do the operation in practice with the necessary simplicity and security. I then devised the most simple and practical of instruments, able to serve for cutting the bone and fulfilling all the desired conditions of technique. My thread saw, which has now entered into surgery, allows one to open the pelvic girdle simply, without difficulty or danger and to replace a serious joint lesion by a simple linear fracture of the pelvis."

II. TECHNIQUE OF THE OPERATION:

(This description of the technique of the Operation is from Gigli's papers in *Ann. di Ostet.* 1894, *Centralbl. fur Gynat.* 1892 Nov. and *Bull. de la Soc. d l'Ostet. de Paris*, 1903, p. 68.)

Gigli describes the operation as follows:-

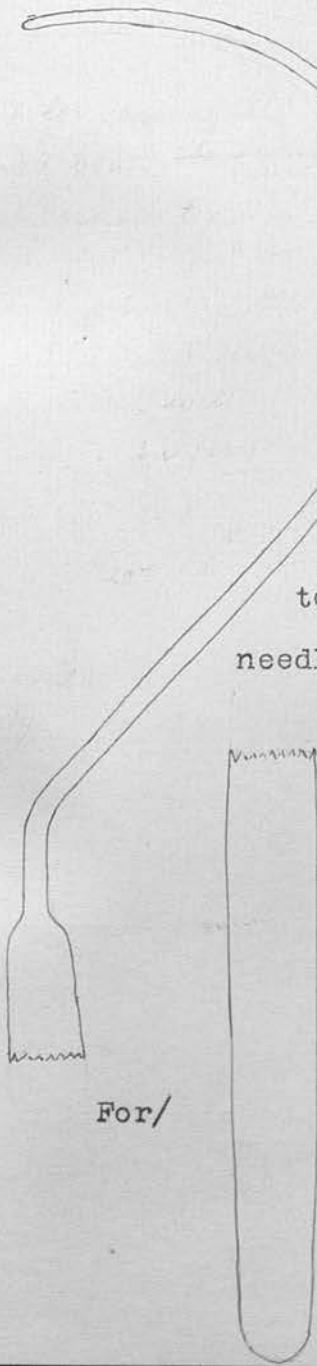
"The operative technique is quite simple. The patient being put in the obstetric position, with the thighs separated, and supported by assistants, the operator stands opposite the perineum. The Mons veneris having been previously shaved and thoroughly disinfected, an incision is made through the soft parts over the pubis, beginning above in the /

the middle line and running obliquely downward to the subpubic tubercle, where the triangular ligament is inserted. Before cutting, draw the skin downward and inward, because thus, when once the incision is made, the lower angle of the wound is placed higher up and more distant from the genital aperture. The cut should go right down to the bone, and the haemorrhage should then be completely controlled. The haemorrhage is usually nil, as in this line are no important vessels. The pubic bones being quite exposed, and the incision carried high enough between the recti, the operator passes through the upper angle of the wound, the silk carrying needle. With two fingers placed high up in the vagina, he guides the end of the needle as it glides along the posterior surface of the bone, and makes the point emerge below, just outside the labium majus further out than the subpubic ligament. In carrying the needle, I seek as far as possible to pass to the outside of the vesical attachment to the symphysis. To gain this, I do not really keep to the middle line above, and do not pass it directly downward to the point of issue, but beginning more to the outside, I first direct it outward and then downward, seeking to make it come out at a point/

point corresponding to the subpubic tubercle between the bone and the corresponding corpus cavernosum. With the needle, a thread of strong silk is passed behind the pubis and put in apposition to the bone surface. With this silk, a wire saw is pulled behind the bone, and without difficulty, the bone is cut through in the direction I have indicated. When the bone is cut along this line, the pelvis opens with ease. If the lower end of the section does not fall beyond the insertion of the subpubic ligament, you may, during the pains and separation of the ends, cut with small scizzor cuts under the guidance of your finger, those fibres which yet offer some resistance. The haemorrhage during the operation is not severe and easily arrested by pressure. In the section of the bone by the saw, it is my advice to cut it not perpendicularly, but as much as possible in a direction oblique to the surface itself, because thus, more extended sections of the bone are got, which are adapted more easily between themselves and do not get displaced, thus rendering superfluous, every kind of suture. I recommend to interfere in the birth with turning and forceps only when the case is urgent; otherwise, I allow the birth to go on naturally and as soon/

soon as complete, to proceed to the suture of soft parts with deep and superficial sutures. It is not necessary to suture the periosteum. There is a linear fracture present, which should be treated as such a lesion is treated in surgery, by immobilisation of the pelvis with starch or plaster casing.

The figure shows Gigli's needle for passing the silk behind the pubic bone, and the curve it possesses for this purpose. There is an eye close to the point for the silk, and it is grooved on its convex aspect. It is quite rigid and as slender as is consistent with the strain to which it is subjected. Gigli's needle is curved on only one plane, but needles with a double curve as in Macewan's hernia needles might be more easily manipulated.



For/

For the operation, a saw and an appropriately curved needle are all that are required, apart from a knife, forceps, sound and haemostatic forceps. The secret of getting the saw to work rapidly is to hold it firmly against the surface of the bone."

III. CASES REPORTED:

Speaking at the meeting on February 19th, of the Obstetrical Society of Paris, Gigli stated that since he published the operation in 1894, it has been performed 9 times, all of which had been successful; all had healed by first intention, none showing any complication in the wound, or leaving any impairment in the pelvis or pelvic organs.

The following is the list in chronological order and with details that the writer of each gives.

Case 1: By Bonardi of Lugano, 7th May 1897. In a garret in the country without chloroform assisted by a general practitioner and a midwife.

Case 2: By Calderini of Boulogna, 6th July 1899, in Hospital.

Case 3:/

Case 3: Van de Velde of Haarlem, August 24th, 1901 (Centralblatt für Gynäk. 1902, 37.) He was not called till woman was 24 hours in labour. There was danger of rupture and he had cause to fear infection of the patient. He incised the soft parts from the left spine of the pubis to a point on the outer side of the labium majus at the level of the vestibule, and led his saw under and round the bone as Gigli proposed. When the bone was cut, a pain drove the head into the brim, and by pressure followed by a low application of forceps, he delivered the patient of a child weighing 4,500 gr. alive. The patient had a slight phlegmasia alba of the left leg, but made a good recovery and was discharged on the 18th day.

Case 4: By Gigli of Florence, 3rd April, 1902; performed in a flat under most miserable conditions with one assistant and a midwife, in addition to the chloroformist.

Case 5: Van de Velde, 23rd July, 1902; performed in Hospital. The operation was done as in No. 3, but version was used for extraction. There was some atony of the uterus, but during the puerperium, everything was satisfactory.

Case 6:

Case 6: Scarlini, Sienna, 21st August 1902. His case is of interest in that it is the only case reported of a primipara.

Virginia R: primipara aet. 30, height 1.41 metres: interspinous diam. 21.5 cm: intercrystal 23 cm: conjugate external 17 cm: diagonal 10 cm: conjugata vera between 80 and 85 mm. The patient refused induction of labour, so full time was awaited and to avoid the troubles following symphysiotomy, lateral division was decided on.

August 19th, 11 p.m. Patient began to feel pains, which continued all night.

August 20th, in the morning, the cervix admitted one finger, which felt the mobile head above the brim covered with the membranes which bulged slightly during the pains. The pains went on all that day and night, and at 7 a.m. on the 21st, the head was found fixed in the brim, and the os dilated to 60 mm. During examination, the membranes burst and a lot of dark green amniotic fluid escaped. The heart sounds were quite normal. The patient was ordered to be kept in Walcher's position as much as possible and she had been in that position also during the night. By 4 p.m., the dilatation being practically complete and the edge of the os being/

being very dilatable, the patient was chloroformed. The necessary preparation for application of the forceps at the brim was made, and in case of failure, provision for the performance of lateral division. Tarnier's forceps were applied to the head at the brim with the patient in Walcher's position, but failed to advance the head in the slightest. Lateral division was then performed without incident, except for some slight venous haemorrhage at the lower angle of the wound, which soon stopped on pressure. "When the bone was cut, the two ends separated spontaneously 5-6 c.m., and then I again applied forceps, using Naegele's, and after a few tractions, I extracted a male foetus 3050 gr., which soon recovered from the asphyxia which it at first exhibited. The after birth came spontaneously after 5 minutes. After disinfecting the vagina, I approximated the osseous walls with hand pressure, sutured the soft parts with catgut, and then applied to the pelvis an immobile starch dressing." The puerperium was physiological except for a slight rise of temperature in the first 48 hours, due probably to the retention of faecal matter in the intestine. On the 19th day, the apparatus was removed, and the pelvic girdle was found solidly united/

united without the patient complaining of the slightest pain. One month after the operation, patient left Hospital perfectly well. (Bollet. del. Soc. Toscan. di Ost. e Gin., p. 168.)

Case 7: Saladino (Sienna) 10th Sept. 1902. This case is described at great length in the last named magazine. The following is the summary of it.

Teresa Francini, aet. 32 rachitic: height 1.5 metres with a flat pelvis. Interspinous diameter 26.5 cm. Intercristal 28: conjugata vera 78 mm.

The first labour was a craniotomy 3400 gr. in 1891.

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|----------|---|-----|--|
| " second | " | " " | version followed by a craniotomy of the aftercoming head, 4100 gr., 1894. |
| " third | " | " " | premature labour: 7 month child died in a few hours, 1620 gr., 1898. |
| " fourth | " | " " | an induced labour at 8th month: it was a breech case and the aftercoming head lead to death by asphyxia, 2380 gr., 1901. |

For her 5th labour she came to hospital on September 10th, at 7 a.m., having had pains since 3 p.m. the day before. At 9, the membranes ruptured spontaneously, the os being 5 cm. By 4 o'clock, there was complete dilatation and at 5, patient was chloroformed and lateral division done by Gigli's method, with/

with the aid of Professor Falaschi. During the incision of soft parts, the haemorrhage was insignificant: when the bone was sawn through, there was slight venous haemorrhage, but no haemostatic forceps were used; it sufficed to apply compresses. When the bones were separated, the head fixed in the brim. Forceps were then applied and the head descended slowly and was extracted without difficulty. There were no lacerations and the wound was sutured; foetus 2920 grm. The temperature after the first 12 hours was normal and remained so, for 24 days, except for some slight rises due to constipation. On the 24th day, the starch apparatus was removed and the cutaneous wound had healed by first intention. The osseous lesion also was perfectly healed, the uterus was completely involuted mobile and painless in normal anteflexion. In fact, she was on the eve of being discharged as well, when she suddenly developed typhoid fever, of which she died in her own home 43 days after the operation, and 18 days after the typhoid fever began to manifest itself. "In this patient no infective process was met with; she had not been examined outside the clinique and the liquor amnii was healthy. I interpret the slight fever immediately following labour as a muscular fever to be attributed to auto-intoxication/

ication, from materials given out by the muscles, which were over fatigued owing to the mechanical obstacle existing in the pelvis. In parturient patients, we often find a slight elevation of temperature, which falls soon after birth not to reappear in the puerperium. This is probably due to muscular effort and not of the nature of infection."

Cases 8 and 9: Professor Pestalozza, September 29, and October 27th, 1902.

Palmira P. 34-6 para: 1st premature and child dead; 2nd living and small: 3rd, forceps - dead; 4th, anencephalic monster; 5th, craniotomy; 6th, premature and did not live. The pelvis was non-rachitic but very small. Conjugata vera 85 to 87 mm. As the pains, though strong, had no effect in fixing the head, it was decided to do a lateral division. There was slight haemorrhage during the skin incision, which was due to having gone too low with the wound, which affected some of the fibres of the ostium below. The bone being cut, extraction was easy - forceps being applied twice. The soft parts were stitched without drainage. Cure was uneventful and unaccompanied by fever. Stitches were removed on the 7th day and union was perfect. Infant weighed 3850 gr. and lived till the 20th day, when/

when it died of convulsions. The post mortem examination showed its lungs perfectly aerated and all the viscera normal, except some oedema of the brain.

Angiolina B: aet. 38, 2 para: 1st in 1899, forceps at the brim; child of 3800 gr. was born asphyxiated and died. The 2nd was a small child born spontaneously. For the 3rd one, she now came to hospital in labour and the pelvis being generally contracted (Conjugata vera 80 to 85 mm.) Nature was first allowed to see what she could do. After 8 hours' unavailing effort, forceps were applied at the brim, but they were unsuccessful. Lateral section of the left pubis was then performed and extraction with forceps was then possible. Child weighed 3800 gr. Haemorrhage was practically nil during the whole operation and the wound was closed without drainage. Adhesion was perfect by the 7th day, when the stitches were removed and 14 days later, osseous union was firm. (Bollet. del Soc. Tosc. di Ost. e Gin. 1902, No. 8.)

Since these 9 cases were done - the last in October 1902 - no more cases occurred till January 6th 1903, when Professor Leopold Meyer performed the operation/

operation which he describes in the Centralblatt für Gynakologie, March 28th, 1903. Meyer reports the case as follows: The patient entered the Copenhagen Maternity on January 6th, 1903, about 5 a.m. aet. 24: she had one child previously - 14 months before - a difficult labour finished artificially and the child dead born. As a child, she suffered from rickets and began to walk at 3 years: she was a small slight woman with a flat rickety pelvis. The diagonal conjugate could be measured only after symphysiotomy and was fully 9 c.m., the conjugata vera was 7 to 7.5 c.m. The occiput presented in the 1st position. The pains began about midnight and the waters burst about four a.m. The os was 5 c.m. in diameter and cervix almost disappeared and the head was found to be immovable over the brim. As the pains, though strong, were failing to fix the head and the retraction ring rising high, he proceeded at 10.30 a.m. to saw through the pubis on the right side. He departed from Gigli's technique in some respects, e.g., he did not make the incision of soft parts oblique, but parallel to the middle line, and in passing the thread saw, he first passed his index finger from below, behind the bone and then passed the needle upon this finger from above./

above. He remarks on the ease of sawing through the bone. The head was then easily pulled through with axis traction forceps; the bone wound gaped barely 5 c.m. There was no damage to soft parts. The bone was stitched with silver wire and the soft parts in 3 layers. A thin drainage tube was placed behind the bone and led out at the under end of the skin wound. The puerperium passed without fever. He says: "The after treatment, which in symphysiotomy is usually so very difficult, was here very much simplified by the application of the mechanical support of Borries. The drainage was removed on the 6th day: on the 17th day, the pubis seemed quite firm. There was appreciable, but not excessive callus. As a precaution, I did not allow the patient to quit her bed before the 21st day, and after a few days, she went about freely. Her gait is easy and natural, and she stands without difficulty on either foot. The union of the bones occurred smoothly without any displacement. The patient nursed the child herself. The child weighed 3700 gr. and measured 51 c.m."

IV. OPINIONS EXPRESSED ON THE OPERATION BY THOSE
WHO HAVE PERFORMED IT.

Van de Velde says the operation is simple, easy to perform and requiring a very short time for its execution, hardly requiring more than 3 minutes from the beginning of the incision till the complete division of the pubis. The separation obtained is ample; as additional advantages of the operation, as contrasted with symphysiotomy, he states,

1. As the saw cut is not in the middle line, the normal support of bladder and urethra is not affected.
2. As the soft parts are much thicker at the side than in the middle line, there is less danger of the wound tearing through into the vagina.
3. On this account and because the clitoris is not touched, there is less danger of alarming haemorrhage.
4. Too great separation of the ends of the bone is prevented by the pull of the adductor longus and gracilis.
5. Immediate healing is more likely between the smooth ends of bone than after the division of the joint and in the latter, the danger of infection is also more serious.

It may be a disadvantage that in hebotomy, the wound lies near the great femoral vessels and should there/

there be haematoma or infection, oedema of the leg on that side is more probable.

He adds he would not do the operation with a conjugate less than 7 cm. (Centralblatt für Gynäk., 1902, No. 37). He suggests the use of the name "Hebotomy" as preferable to the hybrid word "Pubiotomy".

Scarlini says the new operation has two undoubted advantages over the old, viz.,

1. The incision affects less vascular tissues, so that the risk of disconcerting and severe haemorrhage is avoided with anatomical accuracy.
2. The joining together of the bones is safer and more solid than the pseudo-arthritis obtained in symphysiotomy.

"The case has the importance of being the first primipara in whom the operation has been done.

We know that primiparity is a disadvantage even in symphysiotomy, as laceration of the genital tract and urinary organs, so justly feared, are more frequently seen in primiparae. Hence Pestalozza at Amsterdam, wanted primiparity to be a contraindication for symphysiotomy and also more recently for lateral division. I was led to do it in this case by the slight pelvic contraction and the dilatibility of the soft parts. In primiparae, it is necessary to know as far as possible with exactness, the/

the conditions in which it may be attempted without compromising the life of a patient. Is it sufficient, as Dr Gigli states, to leave the natural supports to the vagina, urethra and bladder as we do in extramedian section, or is this not enough, and in what degree and with what mechanism and frequency do lacerations occur?"

Saladino says the operation is simple in technique, easy from the precision of its steps, and the rapidity with which the bone can be cut. It is characterised by absence of haemorrhage and post-operative complications. He thinks it should always be done when temporary enlargement of the pelvis is required.

Pestalozza says that in his first case, he experienced some difficulty, in passing the needle behind the bone so as just to graze it, but attributes this to the technique being new to him. In the 2nd case he managed easily, but thought a more slender silk carrying needle and one less curved, would be an advantage. He was favourably impressed by the small loss of blood, which was less than in any of the symphysiotomies, seven in number, which he had done. From experience gained in his first operation, he tried in the second, to keep the incision/

cision of the soft parts in regions of little vascularity, following the oblique line which marks the outer edge of left labium majus. Here, he met only one small artery which needed to be tied. There was no haemorrhage on cutting or separating the bone, so that after extraction, he at once sutured the parts without needing to use any haemostatic measures. He says that Gigli presents as simpler than it really is, the following point in the operation, viz., the division of the soft parts being completed, it suffices to lay bare the upper edge of the pubis between the two recti, in order afterwards, to introduce behind the symphysis the needle carrying the thread, and to limit oneself to the help of two fingers placed in the vagina to controlling it in its course. The two fingers, says Pestalozza, cannot insure us completely against the occurrence of bladder lesions, even though we displace back the bladder with a sound. Now, this danger may very easily be removed, if, after having laid bare the upper edge of the pubis, one introduces the index finger behind its posterior aspect in order to loosen the retropubic tissues to push the bladder away from the field of operation. In one case, he thought he had injured the bladder, as blood came out by the catheter/

catheter, but though a careful search was made on the wall, when the pubis was separated, no aperture could be found. The patient, nevertheless, continued to pass blood stained urine for some hours.

As regards lesions of the corpora cavernosa clitoridis, Gigli's methods enable one to avoid these with safety. Thus, his decision on lateral division of the pubis must be in favour of the operation compared with symphysiotomy, because the incision may be held at will far from the vascular tissues and because the section of the pelvic girdle is made by a very simple and safe means. Neither of his cases had any fever after operation; both healed by first intention and in the most regular way, without drainage; and in both cases, the consolidation of the pelvic ring was much more rapid than we are accustomed to after symphysiotomy.

Meyer says that he had had four cases of symphysiotomy, all of whom recovered, but in none of them was there so complete restitutio ad integrum as in this case of lateral division. Urinary disturbance was very slight: the catheter was used for the first four days, and bladder douches of Silver Nitrate were employed as prophylactic against cystitis. He says, "Against the sawing through of the/

the pubis by Gigli's method, can be raised, in my opinion, only one point:- Is it quite certain that the small piece of bone which remains connecting with the symphysis is always sufficiently nourished? I believe the answer to be in the affirmative, but more requires to be known regarding the course of the nutrient vessels."

P A R T II.I. THE ANATOMY OF THE FIELD OF OPERATION.

A close study of this is necessary, as the comparison between median and extramedian division of the pelvis largely turns on what are structures injured, or in danger of being injured in the respective operations.

The os pubis, on the section of which the operation turns, is the anterior part of the innominate bone and articulating with the corresponding bone of the opposite side, forms the anterior boundary of the true pelvis. It consists of a body and two rami - a horizontal and a descending one. We are concerned here only with the body and descending ramus. The body is quadrilateral in outline, and possesses two surfaces and three borders. The anterior surface is directed forward and outward, serving for the attachment of various muscles. The adductor longus is attached to the upper and inner angle immediately below the crest, while at a lower level, are attached from within outward, the upper part of gracilis, adductor brevis and obturator externus. The posterior surface is convex from above down, /

down, and concave from side to side. This surface is smooth and forms part of the anterior wall of the pelvis. It gives attachment to the levator ani, obturator internus, some muscle fibres prolonged from the bladder called musculus pubovesicalis and various layers of pelvic fascia to be considered later.

The upper border presents a prominent tubercle, which is called the spine, to which Poupart's ligament is attached. Passing out from it, is a prominent ridge forming part of the iliopectineal line to which is attached a portion of the conjoined tendon, Gimbernat's ligament, and the triangular ligament of the abdomen - a small structure in connection with aponeurosis of external oblique muscle.

Internal to the spine of the pubis is the crest, which extends from that process to the inner extremity of the bone. It gives attachment to the conjoined tendon of internal oblique and transversalis, and posteriorly, to rectus and pyramidalis. The term angle, is applied to the point of junction of the crest with the inner border; to it, and to the symphysis is attached the internal pillar of the external abdominal ring.

The internal border is the symphysis - an oval surface/

surface covered by a thin layer of hyaline cartilage, which is fixed to its surface by the fitting together of alternate ridges and grooves on the bone and cartilage respectively.

The external border bounds the anterior edge of obturator foramen and so is out of the range of the operation.

The Descending ramus is thin and flat and passes downward and outward. The Anterior rough surface gives attachment to gracilis along its inner border, and from within, out to adductor brevis, adductor magnus and obturator externus. Its posterior surface, which is smooth, has attached to it, obturator internus and close to its inner margin, the compressor urethrae. The inner border is thick, rough and everted - more so than in males. On it are seen two ridges separated by a groove. These ridges are continuous with similar ones on the ascending ramus of ischium. The fascia of Colles is attached to the external one and anterior layer of triangular ligament to the internal. The outer border is thin, and forms part of the obturator foramen.

The Symphysis Pubis is an amphiarthrodial joint; covering the end of each bone is a layer of hyaline cartilage, /

cartilage, and uniting these is a layer of fibro-cartilage which often contains a cavity in its centre. It is not lined by synovial membrane, and is rarely found before the 10th year, hence it is probably due to softening and absorption of the cartilage. It is largest in females and was formerly supposed to enlarge during pregnancy. It is usually limited to the upper and back part of the joint. The anterior pubic ligament consists of two layers - the deep fibres pass transversely across and blend with the fibro-cartilage. The superficial ones pass obliquely, decussating with the fibres of the aponeurosis of the external oblique and rectus tendon. The posterior pubic ligament consists of a few scattered fibres between the bones; similarly with the superior.

The subpubic or infrapubic ligament is very important in relation to symphysiotomy. It rounds off the apex of the pubic arch, and is a thick triangular arch of ligamentous fibres connecting the pubic bones below, attached on each side to the descending ramus of the pubic bone and above, to the fibro-cartilaginous disc. Between the crescentic lower edge of this ligament and the upper edge of the transverse perineal band of the triangular ligament, there is an oval aperture through which the dorsal vein of the clitoris passes backward.

The/

The two pubic bones meeting in front, form an arch - the pubic arch, the size of the subpubic angle being 90° - 100° in the female. This arch is filled with structures which are liable to be injured in pelvotomy, either during the performance of the operation or during the separation of the bones:

STRUCTURES IN RELATION TO THE PUBIC BONES:-

1. Structures lying in the Pubic Arch.

The structures lying here are important for two reasons:-

- (a) Because the silk carrying needle has to emerge under the lower edge of pubis, in which manoeuvre it is important to know what structures are touched, and
- (b) During the separation of the bones, the relative probability of a tear in median and extramedian division turn to a considerable extent on the anatomical arrangement of the structures here.

The triangular ligament, which is also called the Superficial layer of the triangular ligament, is a strong aponeurotic membrane stretched across the pubic arch. It is in the same morphological plane as the bony and ligamentous pelvis, and is attached on/

on each side to the internal of the the two ridges on the rami of pubis and ischium. The ligament blends behind with the fascia of Colles and with the deep layer of the triangular ligament. In front, near the symphysis, some transverse fibres pass from one side of the pubic arch to the other, and form a band more or less distinct, called the transverse perineal ligament. This ligament, being a short distance below the subpubic ligament, an oval opening is left between them and through this, the dorsal vein of the clitoris passes. The triangular ligament is pierced by two other structures in the middle line, viz., the urethra 1 inch behind the lower edge of the symphysis and immediately behind that by the vagina. Thus, a line of weakness exists in the middle line, which will tend to yield when the triangular ligament is subjected to a transverse strain as it is when the pubic bones are separated.

Another fascia stretches across the arch in front of this triangular ligament, viz., the Fascia of Colles, which is the deep layer of the superficial fascia. It is attached to the external of the two ridges on the rami of pubis and ischium and blending posteriorly with the last, forms a space enclosing/

enclosing the crura clitoridis, the bulbs, the glands of Bartholin and the small perineal muscles and venous plexuses. The crura lie in grooves in the pubic rami between the two ligaments; each crus is covered by a firm fibrous sheath, which, in turn, is covered by the ischiocavernosus muscle. The crura, after puberty, measure 3-4 cm. in length; they are cylindrical in shape, getting rather thicker as they pass forward, being 5-6 mm. in thickness behind and 10 mm. in front. They arise by a firm attachment to the inner aspect of the ischiopubic rami at a point almost equi-distant between the ischial tuberosity and the summit of the subpubic arch. From this, they run forward, inward and a little upward. They present an upper surface placed against the triangular ligament. The internal aspect covered by ischiocavernosus touches in front the bulb and the bulbocavernosus muscle. The external aspect in apposition with the ischiopubic ramus, leaves it anteriorly so as to form a narrow fissure, which allows a passage to the vessels and nerves, which go to the dorsum of the clitoris. The inferior aspect is lodged in the base of the labium majus, so that in order to expose it, it is sufficient to incise the genite-crural groove and to/

to draw the labium majus inward. The angle of union of the crura is partly filled up by the intercrural tendon of Holl, which is a tendinous expansion of fibres of ischiocavernosus on the dorsal aspect of the base of the clitoris. (Les organes Genito-urinaires, Poirier, p. 578.)

The clitoris is attached to the front of the symphysis by a suspensory ligament which consists of 2 parts - a superficial elastic part, made up of elastic fibres inserted into the linea alba and continuous with those fibres which run through the Mons Veneris; at their other end, they are divided into two branches, which are attached to the lateral aspects of the clitoris and meet on its inferior surface; and, secondly, a deep fibrous part inserted into the fascia of the clitoris and on the antero-inferior aspect of the pubic symphysis.

Vessels of this region.

The internal pudic artery, which, in the ischio-rectal fossa is found in Alcock's canal as it proceeds forward, runs along the inner aspect of the ischial and pubic rami. It is considerably reduced in size by giving off the artery to the bulb, and then, after a course behind the anterior layer of the triangular ligament, it pierces that structure/

ture half an inch below the level of the symphysis and a little external to the middle line. It now divides into the artery to the corpus cavernosum, which pierces the inner aspect of the crus and is carried forward in it, and the dorsal artery of the clitoris which runs forward in the interval between the crura, and passing through the suspensory ligament reach the dorsum clitoridis.

The dorsal vein of the clitoris lies in a groove in the middle line, with a dorsal artery and vein on each side of it. It arises in the glans and as it runs back, receives superficial veins, and veins from the corpora cavernosa. At the root of the clitoris, it dips down between the crura and, passing between the triangular and subpubic ligaments, passes back into the pelvis to join the plexus of veins round the bladder. Rieffel, in Poirier's Treatise of Anatomy, says the deep dorsal vein of the clitoris, which is median and single on arriving under the sub-pubic ligament bifurcates, thus constituting the principal branch of origin of the pudic vein on each side. At the level of its bifurcation, it anastomosis with the anterior vesical veins, the venules of the prevesical fossa, the retro-pubic veins, with the obturator vein, and takes an important part in forming the plexus of Santorini.

The space on each side between the vagina and crus is filled by the bulb of the vestibule, a mass of highly vascular tissue. The posterior bulbous extremity overlaps the gland of Bartholin. The two bulbs communicate anteriorly through the pars intermedia in front of the urethra, and that in turn, communicates with the glans clitoridis.

The superficial perineal vessels run along the inner aspect of the crura, separated from them by the ischiocavernosus muscle.

The internal pudic nerve lies alongside the artery to its outer side and deeper.

2. Structures behind the Pubis.

The various layers of pelvic fascia form rather a complicated connection with the pubic bones.

The parietal pelvic fascia, after converting the Obturator groove into a foramen, gradually sinks on the posterior aspect of the body of the pubis. Its attachment to the body of the pubis goes to within 8 mm. of the middle line and at that point is about 3 cm. from the superior border of the pubis. Traced downward, it is attached to the rami of pubis and ischium in front of the obturator internus and then/

then to the ischial tuberosity. The fascia does not stop at these attachments, but is continued across the pubic arch behind the compressor urethrae muscle, forming the deep layer of the triangular ligament. The two halves of this, on reaching the middle line, sweep back on the urethra and vagina round the anterior border of levator ani and join the visceral layer. Inferiorly, it is attached to the base of the triangular ligament. In front of the/

the transversus urethrae, the deep layer of triangular ligament comes into contact with the superficial layer of triangular ligament and so form the "transverse ligament of the pelvis of Henle", or the "pre-urethral ligament of Waldeyer", or what was described above as the transverse perineal band. (Rieffel, p. 659.)

The parietal pelvic fascia at the side of the pelvis, is the obturator fascia.

The white line, along which the visceral leaves the parietal fascia, runs from the spine of the ischium, behind to a point in front, a little above the level of the lower end of the symphysis. The fascia is specially thickened along this line by a band which springs from the back of the pubis and is traceable back to the ischial spine. The visceral layer of fascia has a direct attachment to the posterior aspect of the body of the pubis a short distance above the lower end of the symphysis, and above the bony origin of the anterior fibres of levator ani, and the attachments of the parietal pelvic fascia. French anatomists describe the part differently, e.g., Rieffel describes it thus, p. 661. It arises in front from the pubis at some millimetres from the symphysis and from this point, from/

from a line which rises outward to the inferior edge of the obturator foramen. It frequently reaches the fibrous arch which limits this opening. He says that to state that this fascia arises from the obturator fascia is true only in front, and a little behind. The white line is not the union between the two, but a strengthening band developed in the visceral fascia; the attachment of visceral fascia is considerably higher, covering the thin tendinous upper edge of levator ani, which closely applied as it is to the obturator fascia, approaches more or less, the innominate line. In front, the two lateral portions approach each other, passing downward and inward obliquely, being carried back to form the external or lateral pubovesical or pubovaginal ligaments, inasmuch as many of the fibres stop at the bladder and vagina. The fasciae do not stop at these lateral ligaments, but continuing onward, the two fasciae meet in the middle line to form the median pubovesical ligament which is lost toward the base of the bladder. There is marked difference between the median and lateral ones - the lateral on each side, form a well marked ridge - the median is only a thin sheet dipping into a fossa 6-9 mm. in depth, and 12-16 mm. in its transverse and sagittal/

sagittal diameters. This fossa contains a little fat, and its base is traversed by veins, notably the dorsal vein of clitoris. Passing inwards, the visceral fascia varies in its termination according to the point one considers. Between the pubis and the posterior aspect of the vagina, it enters into relation with the lateral walls of the urethra and genital canal from which it is separated by large venous plexuses to which it adheres intimately, and to separate it from which, requires careful dissection. Between the vagina and the rectum, the two halves meet in the middle line. At the rectum, the fascia descends between the lateral walls of the rectum and levator ani. Behind the rectum, the two layers again meet above the anococcygeal raphe. w

The bladder is in relation to the pubic bones posteriorly. The inferior surface of the bladder rests directly on the upper part of the bodies of the pubic bones, while in the lower part of the bodies of the bones, a triangular pad of fat, called the retro-pubic pad of fat, intervenes between bladder and bone. The neck of the bladder is attached to the pubis anteriorly by the two lateral and median pubovesical ligaments, while below it, rests on the superior aspect of the vagina. Two aponeurotic sheets pass from the back of the pubis to the lateral part/

part of the cervix uteri, supporting the vagina and bladder and constituting the principal means of support for the latter. Rieffel calls them "pubogenital ligaments".

At the end of pregnancy, before labour commences, the bladder is pushed down and the lower part of the anterior uterine wall is in contact with the pubic bone above. But as labour goes on and the cervix pulled up and obliterated, the bladder and retropubic pad get drawn up till the greater part of the organ lies above the pubis.

The urethra commences at the neck of the bladder and runs through the pelvic floor applied to the antero-superior wall of the vagina. It consists of two segments, a pelvic and a perineal. The pelvic portion behind the triangular ligament, is 20 mm.; the perineal portion is 10 mm., i.e., the part between the layers of triangular ligament 5, and the part below the superficial layer of the triangular ligament, 5 mm.

3. Structures lying in front of the Pubis.

The front of the body of the pubis is completely covered with the origins of muscles. These are/

are all invested by deep fascia which are attached to the body of the pubis and to the side of the pubic arch. From here, it extends down the inner side of the thigh.

The adductor longus arises from the front of the body of the pubis immediately below the crest by a short strong tendon. The adductor brevis arises below the origin of adductor longus from the anterior aspect of the body and descending ramus. The gracilis springs by a thin tendon from the lower half of the body of the pubis, close to the symphysis and from the upper half of the pubic arch. The adductor magnus arises from the anterior surface of the entire length of the pubic arch, and the lower part of the tuberischii.

The external oblique muscle of the abdomen is inserted in the spine of the pubis through Poupart's ligament and into the front of the os pubis, till it reaches linea alba. Those fibres to the front of the pillar form the internal ring, and are attached to the symphysis. Some of the fibres decussate and go to the opposite pubic bone. The triangular fascia of the abdomen is a small triangular piece of fascia that runs from Gimbernat's ligament to the linea alba. Its fibres are a continuation/

tion of the fibres of external oblique of the opposite side. The rectus muscle arises by two heads from the pubis; of these, the external and larger takes origin from the pubic crest, whilst the internal and smaller is fixed to the ligaments in front of the symphysis pubis. The pyramidalis muscle springs from the front of the pubis and ligaments of the symphysis and is inserted into the linea alba.

Superficial to the muscles' origins, lie the Mons Veneris and labia majora. As the incision in pubiotomy runs along the outer edge of the labium majus, it is necessary to study the relations of the latter. The outer aspect of the labium majus is convex and meets the inner aspect of the thigh, forming with it, a deep groove - the vulvo-crural groove. The deep or upper edge is broad and unites the labium with the adjacent structures. In front, it corresponds to the pubis and ischiopubic rami, where these are covered by the origin of the thigh muscles. It then crosses from without inwards, the inner border of these rami opposite, about the middle of the labium and the posterior part rests on the soft parts of the ischiobulbar triangle. In its anterior part, the base of the labium majus covers and lodges the corpus cavernosum of the clitoris and the bulb of the vestibule. In its posterior, it is in contact with the bulbocavernosus and gland of Bartholin.

II.

STRUCTURES INVOLVED IN THE INCISION AND BONE SECTION.

The incision down to the surface of the body of the pubic bone runs obliquely downwards and outwards with the origins of adductor longus and gracilis on its inner side and the adductor brevis on its outer side. In the operation Gigli first described, the incision began in the middle line above, but in the form described by Van de Velde the upper end of the incision is immediately internal to the pubic spine. The track which the silk carrying needle follows will therefore be this:- It passes through the external abdominal ring, the triangular fascia, the conjoined tendon, the transversalis fascia where that is attached to upper edge of the pubic bone. It now passes down the bare area on the upper part of the posterior aspect of the os pubis: the structure lying behind it will depend on the position of the bladder which in turn depends on the degree labour has advanced. The needle soon reaches the insertion of the anterior fibres of levator ani on the back of the pubis where they are covered by the visceral layer of pelvic fascia/

fascia: it has accordingly to pass between the attachment of these two structures to the pubis and the back of the bone: while doing so, if properly placed, it lies external to the lateral pubovesical ligaments. The next structure which it meets is the layer of parietal pelvic fascia, which is carried across the pubic arch as the deep layer of the triangular ligament. Immediately below this lie the pudic artery, vein and nerve of which the nerve and vein lie nearest to the bone. Also between the 2 layers of the triangular ligament lies a muscular sheet called the deep transverse muscle of the perineum of two parts, viz., *Transversus Urethrae* and *Transversus Vaginae*. The needle passes in front of the upper edge of this muscle, between the pudic vessels and nerve and the bone. Piercing the insertion of the anterior layer of the triangular ligament the needle passes between the bone and the corpus cavernosum of that side, emerging at a point opposite the subpubic tubercle. It is expected to emerge beyond the insertion of the subpubic ligament, that is, lower down than the insertion of the transverse perineal band.

III.

COMPLICATIONS ARISING DURING THE OPERATION.

Though from Gigli's description of the operation and the comments on it by those operators who have done it - lateral division of the pubis is not a difficult or dangerous operation - there are nevertheless events capable of occurring during its performance which must be carefully guarded against.

Taking them in the order in which the occasion for guarding against them arises in the course of the operation, the operator must keep strictly to the line laid down for the incision of the integument and subjacent soft parts. If the incision be placed too low, or, though high enough to start with, be prolonged too far back, haemorrhage may be profuse from injury to the venous plexuses which abound in the vicinity. All the operators however, testify to the marked absence of haemorrhage if the incision be kept well forward.

Next, in passing the needle, one must keep it close to the bone as in the event of its point being allowed to wander in among the layers of pelvic fascia there is considerable risk of injury to the bladder. In none of the cases reported did this accident occur though Pestalozza thought he had injured the bladder in/
in/

in one case where blood stained urine came through the catheter, though he was unable to find the injured point and the patient made a good recovery.

Again, where the bone is cut and separated there is danger of a tear occurring here, as with symphysiotomy for reasons stated in comparing the two operations in this respect.

IV.

COMPARISON WITH SYMPHYSIOTOMY.1. AS TO LESIONS OF SOFT PARTS.

The tendency to a tear of soft parts occurring is an important one in pelvotomy as the mortality is largely due to the results of tears, viz., haemorrhage and sepsis.

The tendency for tears to be produced is easily understood when one remembers that across the pubic arch are stretched the various layers of fascia, filling in the floor of the pelvis below, which are firmly attached to the rami of the pubic arch. These layers have between them important structures as seen above - vagina, urethra, crura, plexuses etc. Now when the pelvis is opened anteriorly and the two sides of the pubic arch separated, these fascial and enclosed structures are strongly stretched transversely, and as they are of limited extensibility the tendency to a tear is great.

These structures being the same in symphysiotomy and in lateral division, there is the chance of a tear present in each: the probability of one occurring however/

however is much greater in symphysiotomy and that for the following reasons:

(a) IN SYMPHYSIOTOMY:

Running through the diaphragm across the pubic arch is a line of weakness. This runs from before backward in the middle line, and the diminished power of resistance there is due to the fact that it is here perforated in line by the dorsal vein of the clitoris, the urethra and vagina. The middle line being the weakest part of the segment, symphysiotomy opens it at the worst possible place, as when the subpubic ligament is cut the wound is down to the space in which the dorsal vein of the clitoris lies, and the thickened upper edge of the triangular ligament is all that prevents it extending backward. It is for this reason that Harris of Chicago in the American Journal of Obstetrics December 1894, recommends that after the symphysis is divided the subpubic ligament is not to be cut but detached with the deep perineal fascia from the pubic arch with a blunt pointed bistoury, guiding it with the finger and hugging the bone closely. The pubes should be allowed to separate gradually/

gradually and the fascia detached until its fibres are no longer felt to be tense. By this means he hopes to prevent a tear beginning. Others again, e.g., Dr Buist of Dundee in the Edinburgh Obstetrical Society's Transactions, volume 27, page 127, advises to cut through the subpubic ligament to allow the bones to separate, but if the ligament has been cut through one has reached the dorsal vein which lies in the oval space between the subpubic ligament and the thickened upper edge of the triangular ligament. The latter protects the structures behind to some extent but does not guard the vessels between it and the subpubic ligament at all.

The method of relieving tension by separating the subpubic ligament is good as far as it goes, but does not remove all risk of laceration as there are structures behind the lower edge of the pubis, where tension cannot so be relieved. Attached to the back of the pubis are, as stated above, the lateral and median pubovesical ligaments. In symphysiotomy the opening behind lies between the lateral pubovesical ligaments in the median ligament. This is thin and will tear easily, and as the thicker lateral pubovesical ligaments will not tear when there is a line of less resistance for the laceration to follow, it will tend to run back between the lateral ligaments to the base/

base of the bladder with its venous plexuses; whose vascularity has been increased by pregnancy. That haemorrhage here may be alarming is proved by the case recorded by Trenb in the Ann:de Gyn:1893, page 377, where it was fatal, while others have recorded cases of haemorrhage of varying severity, Zweifel, Braun, Budin, Varnier and many others. The haemorrhage is mainly or altogether venous, and its seriousness is largely due to the fact that the stretched fibres of the torn fascia may hold the mouths of the veins open.

Injury to the bladder is a not infrequent sequel of pelvotomy, and is produced as follows: At the end of pregnancy the bladder lies in the pelvis behind the symphysis: as labour proceeds it gradually gets pulled up, along with the retropubic pad of fat above the symphysis. By this manoeuvre it is kept out of range of injury by pressure in an ordinary labour. In symphysiotomy, however, this advantageous position is lost, as the bladder tends to come down, owing to the fact that it gets pulled down along with the vaginal wall, which gets lowered when the child is pulled through the imperfectly dilated canal. The pulling down of the bladder is rendered easy because its attachments to the pubis are injured by the operation.

Bar in this connection says, p. 92 Lecons de Path.

Obstet: "One is often struck by the ease with which after/

after symphysiotomy the os externum of the cervix allows itself to come down, and the vaginal wall closing on the Foetus, is drawn on and inverted during the manoeuvres of extraction. This tendency to inversion is not merely due to the resistance which the badly dilated cervix offers to the traction which it renders necessary. It is also explained by the destruction of a large number of the strong fibres which attach the genital canal to the anterior arch of the pelvis. The result of this inversion is to increase the tears of the retropubic cellular tissue, and it brings down into the retropubic regions, organs, which, such as the bladder, the anterior cul-de-sac of the vagina and the anterior aspect of the lower segment of the uterus, remain above the pubis in a woman confined in the ordinary way:- This displacement increases the chance of injury to these organs. Finally it tears by traction the anterior fibres of attachment which have not been destroyed before - hence the greater risk of prolapse. To sum up, if the interventions to which one has recourse to terminate the labour, are the immediate cause of these ruptures and displacements, the separation of the pubis constitute a condition favourable to their production."

The laxity of the cellular tissue protects the bladder during the separation of the bones. The vesical/

vesical lesions are most often produced at the moment of extraction of the child. The excessive traction and compression against the posterior edge of one or both bones are the principal agents.

Injuries to the urethra are also frequent in symphysiotomy. The urethral canal may be so torn, that it is difficult to recognise it, or it may appear intact and yet give way when a catheter is passed as in a case of Bar's, or again, the wall may be so injured that a slough forms, and when it separates a fistula results. The median method of opening the pelvic floor present in symphysiotomy increases the risk to the urethra, for reasons stated above.

Risk of injury to the clitoris too, is present in symphysiotomy - an accident which is to be much avoided on account of the vascularity of the organ. The division of the symphysis passes through the attachment of the suspensory ligament of the clitoris, and the subsequent separation of the bones tends to tear it.

(b) IN LATERAL DIVISION OF THE PUBIS:

Instead/

Instead of opening the layers forming the pelvic floor in the weak middle line, anteriorly, the opening here is removed to the side, and in this step lies to a considerable degree the advantage of the new method over the old. Thus there is not so much risk of the tear running back as the opening is separated from the urethra and the vagina, by a thicker mass of tissue. Also the veins and the venous plexuses are safer, seeing the cut is removed from the space immediately below the symphysis in which the dorsal vein and other vessels lie. The only vessel which is in danger in lateral division, is the vein running from the point where the dorsal vein of the clitoris divides, which runs down the pubic ramus to begin the internal pudic: It will be safe, however, if the instrument be kept close to the bone when being passed.

The bladder and urethra too, are guarded by the opening in the pelvic floor, being to the outer side of the lateral pubo-vesical ligaments. The same advantage is present in not subjecting the chief anterior attachments of the bladder to the tearing apart strain which is bound to occur when the pelvis is divided between the pubic attachments of the 2 lateral pubovesical ligaments.

Then, seeing the anterior attachments of the bladder and vagina are left intact, there will not be/

be so much dipping down of the os externum and vaginal walls, as that to which Bar draws attention in symphysiotomy, and as a consequence the bladder will not be pulled down so much behind the wound in the pubic bone. Against this advantage must be placed the fact that the sharp edge of bone present here is more liable to cut any soft tissue pressed against it, than the edge of cut cartilage would be.

The clitoris again is not in the same danger here as in the last. The suspensory ligament is left intact, and the structures in immediate relation to the clitoris above, being undistributed, the probability of a tear is considerably less.

In these ways the chances of lesions of the soft parts are much less in lateral division of the pubis, and to this must be attributed to a large extent the uniformly good results of the operation. By thus avoiding lacerations, one escapes haemorrhage, thrombus formation, urinary complications, shock, and much chance of septic processes developing.

2. FUTURE CONDITION OF THE PELVIS.

Beside the lesions of soft parts, which are the complications/

complications of most importance during the operation and puerperium, there are certain other complications which trouble the patient, after a longer interval, and influence one strongly in favour of lateral division of the pubis as a method of pelvotomy. These complications vary in frequency: some patients escape them entirely: others again show one or all of them and if they are present in a severe form, the patient may be incapacitated more or less for life: They are:-

- (a) Trouble at the point where the pelvis was opened.
- (b) Prolapse.
- (c) Urinary Trouble.
- (d) Difficulties presented in a repetition of the operation.

Taking these in order:

(A) TROUBLE AT THE POINT WHERE THE PELVIS WAS OPENED.

1. In Symphysiotomy:- Here the two surfaces are covered with cartilage which does not unite nearly so well as bone does. A probable reason why the union is often so feeble, is that there is a cavity normally in the joint from softening of some of the fibro-cartilage/

fibro-cartilage in the centre, and not lined by synovial membrane: If the section pass through this cavity the walls of it cannot be expected to form a very firm cartilaginous union later. In any case, union after symphysiotomy, is found to consist of a fibrous band of greater or less length. Bar, who has examined his cases subsequently with regard to this point, says that in all his cases, the union between the pubes consisted in the formation of a fibrous band filling posteriorly the space between the bones. He always notices a depression, not behind where the space is quite filled by the fibrous tissue, but in front where a groove marks the line of the joint. The fibrous band replacing the joint is not always so short that the bones are kept in their original degree of proximity. In 14 of Bar's cases in whom he watched the subsequent progress, he notes that in 5, the bones remained markedly separated. Of these 5, in 2 the separation was so great that 2 fingers could be insinuated between the bones, while in the other 3 cases the interpubic space easily admitted the end of one finger.

Now, though this permanent enlargement of the pelvis may sometimes be of use in subsequent pregnancies in preventing the necessity of the pelvotomy being repeated, it must be looked on as having disadvantages/

advantages which more than outweigh any advantage which may be present in this respect. Thus in one of Bar's cases the patient could only walk with a waddling gait, and could not do much work without experiencing vague pelvic pains. In another, in a subsequent pregnancy the pain from the stretching of the fibrous band as full time drew near was so severe that the patient was confined to bed for some weeks before labour.

2. In pubiotomy:

Here matters are quite different. There are two clean cut bony surfaces, which are far more likely to give a firm and lasting union than two cartilaginous surfaces. If the patient be kept quiet after operation, practically no callus will be thrown out, and a slight ridge will afterwards be the only trace of the place where the bone section was made. The union being osseous cannot stretch, and has none of the disadvantages as in the last, the pelvis being restored to the condition in which it was before operation. The questionable advantage of having a pelvis permanently slightly enlarged is absent after pubiotomy/

pubiotomy, and the absence of enlargement at the expense of strength, is not a thing to be regretted, especially as the patient, after a symphysiotomy, may never have another pregnancy, and so goes through life, unnecessarily crippled.

In this connection Pestalozza says in the "Boll. di Soc. Tosc:di Ost:e Gin:" "If the lateral division gives us the means of preventing in a safe fashion incomplete union, I, for my part, in order to follow up such an advantage, should be well inclined to forego every problematic advantage of permanent pelvic dilation and should much prefer to have, upon occasion, to repeat the operation in a subsequent birth."

Now in all the cases hitherto recorded the osseous union was rapid and complete. When more cases have been done, however, a complication not hitherto observed in pubiotomy may show itself, viz., necrosis of the separated end of the pubic bone. What makes one fear this may occur is this:- Cases have occurred where men have been doing a symphysiotomy, but failing to cut the symphysis with the knife have divided what they thought was the ossified joint with a saw. What they in reality in all probability did, was, unknowingly, to perform a pubiotomy, the cartilage of the symphysis being situated to one side of the middle line. Such a pubiotomy is very near the joint and/
and/

and two men - Harris of Chicago, and Lewers of London - record cases where the cut off end of pubic bone re- *necrosed?*
crossed. There was less cut off, however, than is cut off in the operation of pubiotomy proper. Myer also draws attention to the chance of trouble from this source, viz., Cutting off the blood supply of the inner fragment. I have examined various pelves with regard to the blood supply of the inner end of the pubis, and find that there are numerous small nutrient foramina present on the inner end of the pubis, and some of considerable size, close to the articular end of the bone. These are most numerous anteriorly, especially in the upper part of the anterior surface. Posteriorly they are not so numerous, but are to be found especially about the middle of the posterior surface. These show that the vessels running to the inner fragment are not necessarily cut during the section of the bone, though the vessels running to the foramina may be cut in the incision to some extent.

An examination of the vessels supplying the end of the bone shows that an arterial plexus exists behind the pubic bone formed by one or two small pubic branches, which arise from the obturator artery just as it leaves the pelvis; these pubic branches anastomose behind the bone with the pubic branch of the/

the epigastric artery and with the corresponding pubic branches of the opposite side.

Anteriorly the vessel of supply is the anterior branch of the obturator artery which is distributed to the muscles arising from the front of the pubis. It, too, anastomoses with the corresponding artery of the opposite side.

Thus, the inner fragment has a sufficiently independent blood supply to make one feel confident that there is no risk to its vitality, if there is no unnecessary clearing of the bone during the operation or sepsis introduced.

(B) PROLAPSE.

That there is a tendency for this to follow symphysiotomy is undeniable, and is well borne out by M. Bar's series of cases. In 19 patients on whom he performed the operation, he noticed the complication in four. In the 1st place the patient had been operated on twice in 1894 and 1896: after the 1st operation she had a tendency to vaginal prolapse and the uterus came down almost to the vulva. In 1899 the prolapse was worse, and on the least/

least effort the cervix came out at the vulva. The 2nd case was also one in which the operation had been repeated. After the 1st operation there was a lowering of the vaginal wall, going on after the 2nd to complete prolapse. In the 3rd case there was a complication of pneumonia and infection of the wound of the symphysis, multiple abscesses, etc., operated on in 1898. She was seen a year later with complete prolapse. In the 4th case the prolapse followed the operation very soon, beginning immediately after she left hospital, and becoming almost complete. He says that in 3 others of his 19, there was retroversion of the uterus with lowering more or less marked, of that organ. This condition being looked on as the first stage in prolapsus uteri, there is the large total of 7 out of 19, or 36.8% of Bar's cases, which developed prolapse after operation. One ought, however to state that others as Morisani, Zweifel and Puiard have not noticed it to anything like the same extent: still there must be something in a labour accompanied by symphysiotomy to tend to the production of a prolapse later.

Now sufficient cases of pubiotomy have not been done and those that have been done have not been done sufficiently long to allow one to say it is free/

free from this complication; But looking at prolapse from the etiological point of view, one must, I think, admit that reasons are present in symphysiotomy that are absent in pubiotomy for the production of prolapse.

In relation to the production of prolapse, one must remember that in the pelvis (Hart & Barbour p.67) "owing to the presence of loose tissue a line of cleavage runs round within obturator internus, upper part of levator ani and rectum separating those structures from the vagina. The ring of loose tissue runs as follows:- beginning behind the pubis (retro-pubic fat), it passes on the internal aspect of obturator internus and upper portion of levator ani on the left side, between the posterior vaginal and anterior rectal walls, on the inner aspect of the obturator internus and upper portion of levator ani on the right side, and then back to the retropubic pad. This ring of loose tissue divides the pelvic floor into

1. The entire displaceable portion and
2. The entire fixed portion".

Now, in order to get a prolapse, one requires Intra-abdominal pressure acting in a pelvis where one of two conditions are present or both, viz.,

- (i.) Deficient support from the entire fixed portion and
- (ii) Deficient tone of the entire displaceable portion and slackening of the loose tissue round it.

Deficient support from the entire fixed portion is present in a peculiar way in symphysiotomy cases where there is separation permanently between the pubic bones, no matter how slight it is. For by this separation the origins anteriorly from the pubic bones of the levatores ani get separated in proportion/

proportion to the amount of separation between the bones. Now, the levator ani has an important function in preventing prolapse. Its anterior fibres surround the middle segment of the vagina, being closely applied to the wall of that canal without being attached to it: The fibres meet again in the middle line behind the vagina. Some of the fibres also provide a muscular ring for the lower part of the vagina. In cases where there is relaxation of the means of support of the cervix and upper part of vagina, the levator ani by its tonicity and contractility tends to prevent a prolapse by narrowing the orifice. Now, when the two anterior terminal points of the lateral parts of the entire fixed portion are carried permanently apart, the edge of the fixed portion forms a larger oval than before, and in addition the levator ani fibres are acting at a disadvantage owing to their direction, resulting from the pubic separation. Very little pubic separation will materially enlarge the aperture through which the entire displaceable portion will be only too ready to slip down owing to its diminished tone. It is not only the portion of the opening through the pelvic floor bounded by the levator ani that is enlarged, but also lower down, where the apertures in the layers of perineal fascia/

fascia will be so opened up as to permit more readily a descent of the displaceable portion.

Deficient tone of the entire displaceable portion is also present ⁱⁿ symphysiotomy in a way it is not in ordinary labours. Owing to the section and separation at the symphysis, the attachments of the bladder, urethra, and vagina to it are injured so that when forceps or turning are employed and the child pulled down, there is often considerable tearing of the fibres attaching the parts to the pubis. The pulling down of the cervix too and vaginal walls which follows this loss of support means stretching, if not tearing, of the loose cellular tissue round the entire displaceable portion.

Now, in pubiotomy one would not expect any greater frequency of prolapse than after an ordinary forceps labour. This is due to the fact that

1. The union being osseous, the pelvic girdle will not be permanently enlarged and so the aperture bounded by the entire fixed portion will not be enlarged permanently and
2. That the opening not being in the middle line the anterior attachments of bladder, urethra, and vagina are not interfered with.

Hence, there is not the same chance of these structures being pulled down, giving in turn the loss of tone to the displaceable portion which so helps/

helps to cause prolapse.

(C) URINARY TROUBLE.

This forms a very serious after effect of symphysiotomy, and pubiotomy so far compares very favourably with it in this respect. The frequency is well seen in a paper by M. Tissier in the Bulletin de la Societe d' Obstet. de Paris, p.64, 1903: He is reporting on 20 cases, on whom symphysiotomy had been performed in the various Paris Hospitals, who had sooner or later found their way to the Asile Ledru Rollin, of which Dr Tissier has charge. Only four of the patients could be said to have completely escaped evil results of the operation: the other 16 were affected more or less - some of them permanently:- One had practically lived in hospitals for 5 years. 8 had had phlebitis: 2 had prolapse, while 10 suffered from urinary trouble for periods varying from months to years.

Thus, 50% of those who had to seek help after symphysiotomy had urinary troubles. Incontinence of urine is the chief, and may result from a tear of bladder or urethra, or again may exist without any/

any apparent injury to the parts. In the latter, it would seem that the part of the bladder next the urethra and the urethra itself have been violently pulled on during labour and the sphincter fibres have alone been torn. In these cases incontinence is got without a fistula. This occurred in 4 out of Bar's 23 cases.

Now, in the cases of pubiotomy done so far, urinary troubles have not followed the operation. This is probably due to the slighter chance of evident injury to the bladder and urethra, and to the facts that the chief anterior attachments of these structures are left intact.

(D) DIFFICULTY PRESENT IN A REPETITION OF THE
OPERATION:-

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In symphysiotomy adhesion of the bladder to the posterior aspect of the fibrous band may cause great trouble in repeating the operation: and also adhesion between the urethra and fibrous band. These make the second operation difficult in two ways.

1. The operator is unable to pass a finger behind the band in dividing it owing to the adhesions it has contracted and
2. The cellular tissue having lost its laxity there/

there is much more chance of the bladder tearing when the pubes are separated and the head extracted.

In pubiotomy, as the retropubic tissues have not been so much disturbed the adhesions set up will be less and the passage of the needle correspondingly easier. There will, however, be some adhesions so that it may be wise in repeating the operation to do it on the other side from that on which it was done first. No cases are recorded so far where the operation has been done a second time on the same patient but the power of opening the pelvis at a different point from the first operation seems an advantage over symphysiotomy.

3. THE MOVEMENT OF THE PELVIC BONES DURING THE OPERATION.

The 3 movements viz. separation ~~of the ends~~ of the ends of the bones, Wehle's movement, and the new movement recently described by Sandstein all occur in pubiotomy as in symphysiotomy, as the movements take place at the sacroiliac joints and are independent of the point where the pelvic ring is cut/

cut in front. The only difference is that the muscular attachments in front are slightly altered, as the adductor longus and gracilis remain attached to the portion of pubic bone left attached to the symphysis. Van de Velde says this is of use in preventing over separation of the edges where the bone is cut. If the bone be cut further from the middle line above, the rectus abdominis will remain attached to the inner portion: both recti in that case may interfere with the 2nd and 3rd movements of the longer arc of the pelvic ring. The adductor longus and gracilis attached below would help to counteract this. In any case chloroform puts all these muscles out of action and so the movements may be considered the same in both forms of pelvotomy. The satisfactory manner in which the pelvis enlarged enough to permit the child to pass is evident in all the cases recorded.

Now, considering that pubiotomy accomplishes the object of pelvotomy equally as well as symphysiotomy, and that it avoids so many of the disadvantages of the latter, it is the operation which should always be chosen when a temporary enlargement of the pelvis is needed.

Among the advantages which lateral division has over median, the following may be considered the/

the chief:-

1. Less chance of injury to the soft parts during the operation - including bladder, urethra, clitoris bulbs and numerous venous plexuses and vagina.
2. Surer and firmer union, thus avoiding the unfortunate consequences mentioned above of incomplete union.
3. Greater ease and safety in repeating the operation.

V.

INDICATIONS FOR PUBIOTOMY.

These are

1. All cases where symphysiotomy is done at present and
2. Suitable cases where Caesarian section has hitherto been preferred to pelvotomy on account of the undesirable sequelae of symphysiotomy.

The class of cases included thus is best seen by a consideration of Bar's teaching as to treatment of cases of contracted pelvis. It is as follows.

I. DURING PREGNANCY.

If consulted in time to express an opinion on induction of labour.

- (a) In pelvis below 80 m-m. never induce labour.
- (b) In pelvis above 90 m-m. readily induce if you anticipate difficulty later.
- (c) In pelvis between 80 & 90 his practice varies.
 1. From 85-90 induce because if left to full time she will need Caesarian section or symphysiotomy; or if she escape with forceps or turning the child runs considerable risk.
 2. From 81-85 the risks at full time are greater still but infantile mortality from premature labour here is also high, viz. 31.5%. Treatment is then decided as follows: If the conjugate be nearer 81/

81 than 85, if pelvis be generally contracted and if she be a primipara he does not induce labour. If the patient be a multi-para, if the conjugate be nearer 85 than 81, especially if the cavity be simply flattened at the upper strait and the cavity be roomy, he readily induces labour.

II. AT FULL TIME BEFORE ONSET OF LABOUR.

If the patient and child are in good condition, if the disproportion between the capacity of the pelvis and the volume of the foetal head is such that one cannot expect a spontaneous birth or success with forceps or version, he recommends Caesarian section before onset of labour.

III. DURING LABOUR.

If labour is just commencing, child all right, and he thinks the mother is free from infection and unable to be delivered naturally or by forceps or version, he does Caesarian section.

If labour is advanced.

(A) If child is alive and he thinks forceps or version will be enough he uses one of them.

1. Forceps if the patient is a primipara, if the foetal head is already fixed, if the waters have long since escaped and if he thinks Bandl's ring is rising.
2. Version/

2. Version if the woman is a multipara, if the head is movable, above the brim, membranes intact, and uterine wall soft or when there is prolapse of the cord.

(B) If mother and child are well and membranes intact, but he thinks forceps or version will fail, he does Caesarian section in preference to symphysiotomy in all cases.

He does symphysiotomy if the membranes have been long ruptured, if efforts at forceps extraction have been made ineffectually. He only does Caesarian section in such cases if the pelvis is very contracted and measures less than 60 mm. in which case Caesarian section is indicated absolutely.

(C) If the escape of meconium, feebleness and irregularity of the heart sounds etc. make him think the child is suffering, he prefers to refrain from symphysiotomy and still more from Caesarian section; Similarly if he think the mother is infected. In these cases he uses forceps and version and if he fail he does embryotomy even though the child has not died.

(D) If the child is dead, he does cephalic embryotomy in preference to version or forceps, however little difficulty these operations appear to present.

Now/

Now pubiotomy should replace symphysiotomy in these cases in class B. where the latter is recommended and probably will replace those cases where Caesarian section is recommended, not because symphysiotomy will not give enough room, but because it is such an unsatisfactory operation in many respects. For though Caesarian section is a comparatively safe operation in Maternity Hospitals, there is no question whether it or pelvotomy is the safer operation to perform in the surroundings one has in general practice.

Though the after effects of symphysiotomy are usually more troublesome than those of Caesarian section, yet the latter is inferior to pubiotomy in this respect. The results published so far show that it is an operation which can be done safely at the time and with most satisfactory after effects. The fact that the operation has been done in its first 10 cases successfully by 8 different operators for the first time, as well as the fact that every one of the patients was quite free from troublesome after effects is the best proof of its superiority to symphysiotomy always and to Caesarian section when suitable. Of course there are many cases when symphysiotomy will not give enough enlargement to the pelvis: under 60 mm. it is sure to fail.

Van de Velde/

Van de Velde gives 70 mm. as the lowest he would do it in, and Morisani gives the same limit for symphysiotomy.

These low diameters however, are not the best cases for pelvotomy: If seen early enough, i.e. before membranes have ruptured and forceps tried, Caesarian Section is preferable as it shares the soft parts from the severe crushing and chance of tear present in pulling the child through the narrow pelvis. But in pelves with a diameter of 70 and over, pelvotomy by this new method is evidently the best proceeding saving the mother from Caesarian Section and Craniotomy.

The diminished risk from haemorrhage and sepsis make pubiotomy a much safer proceeding to employ out of hospital than symphysiotomy is at present:

It is very important in doing a pelvotomy of either kind to wait until the labour has so far advanced that the os uteri has opened sufficiently - full dilation of the cervix is not got when the head is prevented passing the brim, but the longer labour has gone on within reasonable limits, the greater is the dilatability of the parturient passages. This delay is especially needed in primiparae, owing to the narrowness of the passages.

VI.

SUGGESTION AS TO SIDE ON WHICH TO OPEN THE PELVIS.

The operation may be performed on either pubic bone but Gigli says nothing as to which is most suitable in any given case. Owing to the movements the head goes through in the pelvis, one would think that one side might be preferable to the other in each case. All the operators except Myer seem to have done it on the left side but do not give their reason for doing so.

To decide which side will be best in each case one has to think of the mechanism of the head in a deformed pelvis. In a flat pelvis with room in the transverse diameter, the head will lie at the brim with its long axis in the transverse and the tendency will be for the narrowest part of the head viz. the bitemporal diameter to be opposite the promontory while the broader biparietal will be lateral to that. This means that in a Left position the left half of the upper part of the pelvis is more fully occupied than the right and vice versa: and the result is that it is much more difficult to pass/

pass the needle on that side unless you first disengage the head, which it is not desirable to do. The better plan is then to perform the operation on the opposite side, both because it is easier to pass the needle on the open side, and because there will be less pressure of the soft part on the cut ends of bone.

The opposite side from that on which the occiput lies is the better for another reason. When the occiput is rotating under the symphysis, if the cut be on the same side, the soft parts will be much more pressed against the ends of the bone than if it were on the opposite side, and moreover if a bad grip be taken with forceps the broad part of the head will be pulled down against the bone cut, as it passes through the pelvic cavity.

These risks will be diminished if the bone cut be made on the opposite side from that on which the occiput lies. I therefore think that it would be advisable to divide the right pubis bone in left positions of the head and the left one in right positions as the risk of lacerations would thereby be diminished,

B I B L I O G R A P H Y .

The literature on the subject is limited in amount, there being none in English. The following is a list of what has been written on it on the Continent, arranged according to the date of publication:-

1. Centralblatt fur Chirurgie, 1894, No. 18 - Gigli's description of his saw.
2. Annal. di Ostet. e Gin., 1894, Oct., p. 647-667; Gigli's Article, "Taglio Lateralizzato del Pube, suoi vantaggi, sua technica."
3. Ibid, 1898, No. 1; Bonardi's Article, "Taglio Lateralizzato del Pube col filo sega Gigli."
4. Ibid, 1900, No. 6; Gardini (Calderini's case), "Il secondo caso di Pubistomia col filo sega Gigli."
5. Centralblatt fur Gynakologie 1902, No. 37, Van de Velde, "Die Hebotomie".
6. Bollet. della Soc. Toscana di Ost. e Gin., 1902 No. 5, Gigli's "Taglio Lateralizzato; Considerazioni Cliniche."

7. Ibid, 1902, No. 8:-

Pestalozza, "Due Casi di taglio lateralizzato del pube".

Scarlini, "Il primo caso di taglio lateralizzato del pube nella Clinica di Siena".

Saladino, "Il secondo taglio lateralizzato del pube nella Clinica ostetrica di Siena".

8. Centralblatt fur Gynakologie 1903, No. 13;
Meyer's, "Ein fall von Lateralchnitt durch das os pubis nach Gigli".

9. Bullet. de la Societe de l'Obstet. de Paris,
1903, p. 68, Gigli's Description of his operation before the Obstetrical Society of Paris.
