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FRACTURES AND OTHER INJURIES OF THE CHILD DURING DELIVERY.

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This subject represents but a small corner of the large field of medicine. Omitted from works on surgery, barely hinted at in manuals of medical jurisprudence and briefly, if at all, referred to in works on pædiatrics and obstetrics, it would seem to be entirely lacking in importance.

*A priori*, the act of parturition should be for mother and child as physiological and as safe as the act of eating. Yet it often involves danger to the lives of both, and at its best it is for the mother an agony that cannot be adequately described. One can almost believe that the Primal Curse, "In sorrow shalt thou bring forth children," has been literally verified. Medicine has done not a little to diminish that agony and that danger. Such part of its work as is preventative, namely, the use of asepsis, is absolutely correct and scientific, but what is remedial, such as the use of chloroform and instruments, is not free from evil and is at best a makeshift.

The purpose of this paper is to safeguard the child by pointing out one class of dangers that not rarely complicate and embarrass its entrance into the world. Nor is the subject as unknown and as unimportant as at first glance seems to be the case. It has been a favorite topic for inaugural dissertations, and the number of monographs that have been written about it is surprisingly large. Its importance is far from slight. The physician's reputation is hazarded on every abnormal presentation of the fœtus. It is often part of a doctor's profession to bear in silence misconception and criticism for accidents that are not due either to his action or his inaction. This is perhaps the case more

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in obstetrics and surgery than in general medicine. He can find his consolation only in the thought that the laity cannot understand the problems set before him, and hence cannot judge justly; and he must have courage to still go ahead doing his level best. Some old teacher once said to his class: "A fracture is a simple injury, but if you don't set it right, you will be likely to meet your crippled patient at every corner on your daily rounds." A babe crippled or paralyzed by the act of birth will be much more of a reproach to an accoucheur than a dead-born one. Besides there is always the danger (cases have happened) that obstetrical mishaps may be made the basis of damage suits. Nowadays, when the avarice of lawyers goes about like a street-walker, seeking unholy alliance with the ignorance of the laity, such danger is not to be despised. But the gravity of obstetrical accidents for the physician is insignificant compared with their gravity for the child. A crippled frame, perhaps a ruined life, is involved. Paralysis, wry neck, so-called congenital hip dislocation, pelvic deformities that pass on the curse of birth to further generations can, beyond a doubt, frequently be traced to injuries inflicted upon the unfortunate victim at his or her birth.

Medical reports show that, apart from asphyxia, the following injuries have actually been inflicted upon the child in the act of delivery: Depression and fracture of the cranial bones; rupture of sutures and of sinuses; hæmatoma and rupture of various soft tissues (especially the sterno-cleido-mastoideus muscle); paralysis of facial and other nerves; fracture of vertebræ, jaw, ribs, humerus, clavicle, scapula, pelvic bones, femur, tibia, and fibula; separation of epiphyses of all these bones; dislocation of shoulder and hip-joints; rupture of sigmoid flexure; rupture of liver and other internal organs. In order to determine exactly what injuries do occur in delivery, Carl Ruge made dissections of 64 bodies of infants that died *in partu*, or shortly afterwards. All were cases of breech presentation, either primary or secondary (that is, after version); 38 of them were found to have one or more of the above-named lesions. That such a variety of injuries is possible in what is meant to be a physiological process is a deplorable fact, but it is only equivalent to saying that force will make traumata, whether applied by a railroad train or the jaws of a forceps or the resistance of a narrow pelvis. A study of these injuries shows that some are entirely spontaneous, due to Nature's effort to overcome obstacles for which she may or may not be responsible; some are caused by the accoucheur designedly as the choice of two evils; and some, though few, are due to errors of judgment on his part, or, more culpably, perhaps to his inattention or

haste. Persons who think superficially, particularly among the laity, will attribute such mishaps to the incompetence of the obstetrician, but all who have investigated the subject will judge far more leniently, and I agree with Rosenthal, who says that "frequently all the skill and ingenuity of a well-trained and competent obstetrician are insufficient to prevent them." Speaking of his own obstetrical accidents, this frank and honest reporter says that "despite the precautions and care taken, injuries would result which we were powerless to avert," even though he had the hospital advantages of anæsthesia and competent assistants.

The percentage of injuries is not easy to determine. This is due to a peculiarity of Nature which strikes most people dumb when there is question of confession, but hands them a trumpet when there is opportunity for self-praise. The doctor who "never lost a case" also practises obstetrics, and if he should accidentally notice a mishap, why—the serpent or the apple or the woman (especially the woman) was to blame, and so he is charitably silent about the affair. Another reason is that the injuries inflicted are frequently serious enough to cause the death of the child, and no motive except possibly a scientific one remains for close investigation.

Breech presentations furnish the chief occasion of injury to the infant, particularly induced or secondary breech presentation. According to the statistics of Mannheim Hospital,\* primary breech presentation occurs in  $2\frac{4}{18}$  per cent. of confinements, and version (induced or secondary breech presentation) was found necessary in exactly the same percentage,  $2\frac{4}{18}$ . Ruge's dissections showed that in 21 cases of primary breech presentation, 11, or 52 per cent., were injured, and in 42 cases of secondary breech presentations, 27, or 64 per cent., were injured. Rosenthal's experience was 9 injuries (omitting asphyxia) in 24 secondary breech cases, or 38 per cent., and 7 injuries (excluding 5 cases of asphyxia) in 27 primary breech cases, or 26 per cent. These figures, not being based on post-mortem examinations, are naturally smaller than reality. Rosenthal adds that "when the foetus succumbs to the manipulations I feel sure that death is due more frequently to injuries inflicted than to asphyxia." Fösterling has published his study of the records of confinements in the hospital and out-door dispensary work in Halle. In 3982 deliveries in the hospital, 51 cases (1.28 per cent.) of injuries were noted. The breech presentations numbered 182, with 7 per cent. of injuries; and 117 head presentations required forceps, resulting in 7 cases (6 per cent.) of paralysis. In 6171 confine-

\* See *Obstetrics*, April, 1899; *The Mannheim Method of Conducting Labor* by D. J. Doherty, M.D.



ments in out-door practice, 165 (2.67 per cent.) injuries were recorded. There were 989 breech presentations, with 77 (8 per cent.) injuries; and 626 head presentations needed forceps, resulting in 56 (8.9 per cent.) injuries. These data of Fösterling are clearly unsatisfactory because based simply on written records without evidence of accuracy or completeness. The figures of Ruge and Rosenthal pertain to breech cases, and do not include cephalic presentations in which injuries may occur spontaneously or may be produced by instruments.

A rough idea of the frequency of serious injuries may also be gathered from a brief summary of cases of obvious and easily recognizable traumata (for example, of long bones) which have been reported in medical literature.

Smellie (1764) was probably the earliest reporter of these cases. In the third volume of his "Midwifery," consisting of notes on nearly a thousand confinements, he mentions two fractures of the humerus and three fractures of the femur. One humerus was broken in utero whilst Smellie was making a version, the child being small and the delivery easy, and this he attributed to the thinness of the child's bones. The other was a case of placenta previa. Of the fractures of the femur, one occurred in his own hands and two in the practice of his assistants. One of these assistants was much discouraged because the child died later from the inflamed fracture, and Smellie says: "I told him that such things would sometimes happen even to the best and most careful practitioners." He also had a dislocation of the humerus which he did not recognize till several months later. "This," he says, "was the only luxation that ever happened to me in practice where the child was alive."

Osiander (1825) reports an instance of both femurs being fractured. During the act of extraction an alarm of fire was given, and fright caused the woman to make a sudden movement which snapped both bones.

In the *Verhandlungen der Gesellschaft für Geburtshilfe*, at Berlin in 1852, Diesterweg reported a fracture of the humerus which occurred in a case of prolapse of the arm. In the ensuing discussion, Credé told of a fracture of the femur in his own practice caused by lifting the body during extraction too strongly against the pubic arch.

Michaelis ("Das Enge Becken," 1851) mentions four fractures of the clavicle that he had designedly caused in difficult cases.

Pajot, in 1853, published a thesis on this subject containing a number of cases culled from earlier literature. Thudichum (*Berl. Illustrirte Med. Zeitung*, 1855) reported two cases of separation of upper humeral, one of upper femoral, and one of lower femoral epiphyses. Ahlfeld

presented to the Obstetrical Society of Berlin, in 1872, a specimen consisting of two thoracic vertebræ which had separated at their epiphyses in an extraction. The child had lived nine days, but the injury was not recognized till the post-mortem. At the same time, Schatz reported that he had had one fracture of the humerus and six of the clavicle in between 40 and 50 versions.

In 1874, Carl Ruge read before the Berliner Gesellschaft für Geburtshilfe the best exposition of the subject up to that date. In his dissections (already mentioned) he found the femur fractured twice, the humerus four times, the clavicle five times, separation of the clavicular epiphysis once, of the upper humeral once and of the tibial once.

Kuestner used our subject as a thesis for his inaugural address at Halle in 1877. After quoting from Lachapelle a case of separation of the tibial epiphysis; from Fritsch a fracture of the femur and one "above the malleolus;" from Seeligmuller a fracture of the lower part of the scapula, and two of the neck of the scapula; from Ciezlewicz a separation of the epiphysis of the collum scapulæ; from Duchenne four infra-spinous luxations of the humerus; from Gurlt a separation of the upper humeral epiphysis, and from Hecker a fracture of the humerus, he gives out of his own practice the following mishaps: Fracture of the femur, 1; of the humerus, 1; of the clavicle, 1; separation of epiphyses of upper humerus, 4; of caput colli, 1, and of tibia, 1. His cases occurred chiefly whilst he was in the service in the hospital at Halle. The clavicle was fractured whilst reaching for the extended arm, even before he seized it. The fracturing force was the lateral pressure upon the shoulder by his hand in the narrow pelvic space. The fracture of the humerus occurred in a case of placenta previa, but Kuestner says that a more self-possessed accoucheur might have avoided it. He describes the occurrence of the fracture of the femur as follows: He was called to a young primipara who had been twelve hours in labor, the breech presenting. He saw no indication for interfering by bringing down a foot, and so waited four hours longer, when the breech became fixed in the pelvis. After another hour the pains grew weaker, and he began to fear tetanus uteri. He hooked a finger in the groin, but was unable to bring the breech nearer. He then passed a fillet around the upper hip and drew with great force. This brought some progress, and he was able to insert two fingers over the fillet. Thus pulling, the breech suddenly yielded, and a snap which was audible to the husband in an adjoining room indicated a fracture. The leg was then drawn out and the child extracted.

A. R. Simpson, Professor of Obstetrics at Edinburgh, read in 1880,

before the Obstetrical Society of that city a paper in which he states that a year before he had reported a case of placenta previa, and had described the child as having extensive lacerations and bruises of the soft parts, great swelling of the left leg which hung stiffly from the pelvis, ecchymosis of the upper thigh and abrasions at the malleoli. He had then thought that there was no injury of bone or joint. He had, however, in the meantime, had a similar case, and the child being dead he was able to make a thorough post-mortem examination. Deformity or crepitation was not apparent, but the foot hung loose to the tibia, and there was abrasion over the malleolus internus. The dissection revealed separation of the epiphyses of the upper femur, lower tibia, and lower fibula in the right leg, and of the lower tibia in the left leg. He adds: "On looking back over my own practice, I fancy such fractures as I have described must have taken place in one or two cases where I was well aware of a kind of a 'chuck' sound or sensation—I can hardly tell which. At the time I did not think more of it as the children were dead, but I supposed that some ligament had torn."

Ten-Eyck (1880) reported to the Albany Medical Society the following case: A primipara, æt. 20, was in labor with child in breech presentation. The nates became impacted at the pelvic floor and did not yield to severe pains. He inserted a finger in each groin, and after six or seven gentle efforts, he heard and felt a crack. One femur had fractured. In the discussion of the report, Collier reported a similar case in his practice, and Van der Veer stated that he had met in consultation more cases of fracture of humerus than of femur, one of the former being in the practice of a distinguished obstetrician, and that "the accident is liable to occur to any one and cannot be avoided."

Belluzzi (*Mem. dell'Accademia delle Scienze*, 1881) had a case of high impaction of the breech. He was unable to bring down a foot, or to insert his finger in the groin, so he used the blunt hook. A fracture of the femur resulted. In another case he fractured the horizontal ramus of the pubes, recognized it by the swelling and crepitation, and verified it by a post-mortem some days later.

Johnson (*Australian Med. Gazette*, 1883) had a compound fracture of femur due to the blunt hook in high impaction of the breech.

Parvin, in 1887, read a paper before the Medical Society of Philadelphia, and reported that in one case of version and extraction he had a separation or fracture of the cervical vertebræ. In the discussion, Leaman said he had once fractured the inferior maxilla, and once had met a fracture of the clavicle. Goodell showed a pathological specimen, a humerus which he had fractured and of which he was proud because



he had saved the child's life by fracturing the arm. It died a year later of cholera infantum, and he obtained the specimen which showed perfect union. He also reported a case of fractured clavicle in spontaneous head delivery. He added: "A child presenting by the breech is a child drowning, and help must be sped—help at all hazards." Longaker also reported a fracture of the femur and one of the humerus. Lusk said he considered it justifiable to break the arm if necessary to hasten the delivery where the space was small or the arm was displaced.

In the *Archiv für Klin. Chirurgie*, 1890, Von Büngner investigated cases of pseudo-arthritis that had been presented to the clinics of Halle and Leipzig from 1874 to 1890. Whilst not a few were probably due to fracture at birth, in five fresh cases he was able to trace up the history and verify that this was the fact. One was a spontaneous head-birth, the child being large and the maternal pelvis small. The pressure of the tibia against the pubes had caused a fracture which was neglected and led to pseudo-arthritis. The other four were breech presentations.

Remy of Nancy, France, reported a case of spontaneous head delivery in which both femurs were fractured. The mother was healthy and well built, but the child was found to have ankylosis of both hips and both knees, a condition that easily explains the remarkable accident.

Godfrey of Galena, Ill., reported in the *Chicago Medical Review*, vol. 5, a separation of the humeral epiphysis in cephalic presentation. It occurred whilst he was aiding the birth of the shoulders with his finger in the axilla.

Heyrich reported in 1890 that he had made extraction in a case of foot presentation with prolapse of funis. The right arm was behind the head, and in freeing it he had broken the clavicle. Thirty hours later the infant was found dead in its cradle with a large soft tumor extending from the lower jaw to the right thorax. Post-mortem examination showed that an end of the broken clavicle had made a minute wound of the costal and pulmonary pleuræ, which led to pneumo-thorax and emphysema of the skin, and finally to atelectasis of the right lung.

Detwiler published in the *International Medical Magazine*, 1893, the case of a child born spontaneously in head presentation with both femurs fractured. He has kindly written me further particulars about this case. Both parents are healthy and well built, and the three other children were also perfect. The babe in question had, and still has, fragile bones, which have repeatedly been fractured. This condition of osteomalacia intra-uterina was perhaps due to the mother's efforts to reduce her copulency by dieting whilst carrying the babe.

Hoffa exhibited in the Physikal. Med. Gesellschaft of Würzburg, 1897, a boy with pseudo-arthritis about a hand's breadth above the right ankle joint. The birth had been spontaneous, and Hoffa considered that the fracture resulted from pressure of the tibia against the pelvic ring.

In the *Medical Record* of last year Abraham reported a case of dislocation of the hip-joint in powerful traction for breech delivery, and a double dislocation of the jaw caused by traction on it whilst liberating the aftercoming head.

Hahn, in the *Prag. Med. Wochenschrift*, 1898, records a luxation of the right shoulder and a separation of the lower epiphysis of the right femur in a version and extraction case.

I have already quoted Rosenthal, who found 3 fractures of humerus and 1 of clavicle in 24 cases of version and extraction; and 1 fracture of humerus and 3 of femur in 27 cases of primary breech presentation. Likewise have I quoted Fösterling, who found in the records of 1169 breech cases 5 fractures of humerus, 6 of femur, 3 of clavicle, 4 of jaw, 2 of malleolus, 1 dislocation of hip, and 1 separation of upper humeral epiphysis. To this series of obstetrical mishaps I have to add two from my own experience. In February, 1896, I was called to a midwife's assistance. The parturient woman, who was middle-aged and stout, had already had eleven children and two miscarriages. Her labors had always been difficult, and two of them required forceps. The case was a placenta previa, and there was excessive hæmorrhage which required prompt measures. I made a version and extracted. In bringing down one arm I fractured the humerus.

The second case occurred a year ago. The mother, who is slightly built, had three children previously. The breech presented, but though the pains were strong, it remained impacted at the floor, finally becoming blue-black in color. I inserted a finger at the upper groin in order to assist and felt a bone snap. The leg then came down easily, and served as a handle for traction. The delivery of the body and head was quite difficult; the child was asphyxiated, but was finally resuscitated.

This summary of reports enables us to state that serious injuries to the infant in delivery are not rare, and that they may happen to any practitioner. It further throws some light upon the mechanism of the injuries, and leads to an understanding of the causes which produced them.

A number of experiments have been specially made by Pajot, Delore, and Kuestner for the purpose of investigating the mechanism of such injuries, and these will be briefly summarized in this paper. There are,



however, several questions which ought to be considered in order to reach a complete understanding of the subject.

First, it may be questioned whether any of the injuries referred to, and if so which, can be produced spontaneously; that is, by the forces of Nature alone, and without intervention by the accoucheur? That a narrow pelvis, actually or relatively to the child's size, may cause facial and other paralyses, or even fracture of the cranial bones, is conceivable; but that other injuries, particularly of the long bones or the sheltered organs, should happen spontaneously even in normal pelvises and in normal children is not so credible. Where a condition of osteomalacia exists, as in Detwiler's case, or in the famous case told by Chaussier, in which over 100 fractures were found, fracture may of course occur, either in the womb through traumata or muscular movements, or in the act of birth by pressure of the birth-canal. Such accidents were at one time attributed to "maternal impressions," and it was explained that the pregnant woman had witnessed some criminal broken upon the wheel. This view was stoutly resisted by a savant, who advocated in a paper before the Faculty of Medicine in Paris, in 1813, the theory that they were due to the concussions of powder explosions so frequent in the battles of that period. We, however, will be satisfied with the learned name *osteomalacia intra-uterina*, and understand how this condition might result in fracture or other injury from any simple trauma, abrupt movement, chill, or convulsion on the part of the mother, or from pressure between uterine expulsive efforts and resisting canal, and much more easily, of course, from the manipulative efforts of an accoucheur.

That a fracture may occur in a spontaneous head delivery is certain from a case reported by Goodell during the discussion of Parvin's paper. The patient had strong pains, but the head which presented did not descend. "Suddenly, during a severe pain, a hand shot out of the mother's anus without tearing the perinæum. Whilst gazing at this in amazement, another pain came on; there was an audible snap, the hand suddenly disappeared from the anus, and the child was born with a fractured clavicle." The mechanism of the accident was as follows: The arm of the child became displaced behind its neck; as the head descended, the hand was forced through the recto-vaginal septum and out through the anus; with farther descent, the arm was driven up along the dorsum, necessarily twisting and breaking the scapula. This singular case negatives the opinion of Von Hoesslein that fracture of the clavicle can occur only in assisted deliveries, and also the opinion of Rosenthal, that "in cephalic presentation the pelvis of the mother being

of normal size and the child of normal size and weight and no impediment in the way, injury to either mother or child is out of the question."

Another question concerns the possibility of causing dislocations by traction or otherwise in delivery. It has been asserted that separation of the epiphysis would occur rather than dislocation. For example, in his recent elaborate work on "Traumatic Separation of the Epiphyses," Poland says: "It is questionable whether many, if not all (such lesions), were not due to a diseased, or at any rate an altered, condition of the bones. Cruveilhier, in 1849, declared with much veracity that they were due to putrefactive changes following the death of the child before birth." "It is true that attempts to produce dislocations at the hip by traction on the limbs of the foetus only separate the cartilaginous ends of the bones. Queretin and Champmas were never able to produce dislocations in the new-born." The incorrectness of this assertion as an absolute statement will appear from the experiments to be detailed.

Brodhurst, in Holmes' "Surgery," studies the subject of congenital dislocation, and considers that the flexed condition of the limbs in foetal life causes the heads of the femurs to press against the inferior and posterior parts of the capsule. He thinks that simple extension and much more traction with hook or finger might easily cause the ends of the bones to slip out of the shallow cotyloid cavity. Whence it would follow that congenital dislocations are often at least due to the act of delivery, and that they are connate rather than congenital. At the meeting of the Berlin Obstetrical Society, in 1852, referred to above, Groeschen spoke on this subject and stated that Velpeau considered these luxations to be connate or acquired in delivery, whilst Dupuytren held them to be due to intra-uterine conditions, and hence truly congenital. This phase of my subject presents a fascinating field for speculation, experiment and observation, but it is too vast for consideration here. I will only say that if congenital hip dislocations are really congenital, we should find them also in cephalic presentations and in normal deliveries. And I would suggest that the time has arrived for doctors in returning reports of births to the public authorities to give specific details of presentation, anomalies or other special features of each case. Accurate statistics and information of this kind would enable us to mark out clear and definite limits of knowledge and perhaps enable us to cast into the medical lumber-room of discarded notions words like congenital, inherited, idiopathy, and others which are often mere cloaks for ignorance.

The experiments of Pajot, Delore, and Kuestner were made with

cadavers of new-born infants. The two former merely studied the resisting powers of the tissues, whilst the latter also endeavored to imitate the act of Nature by placing the cadavers in a phantom pelvis and applying force in the directions found in delivery. I will state their results as given for the long bones.

*Clavicle.*—The clavicle, if suspended horizontally, with support at both ends, will break in three minutes under a weight of three kilos. It cannot be broken by strong traction on the arm downwards, nor by sweeping the extended arm down across the face. Marked elevation of the shoulder so as to make the clavicle nearly parallel to the axis of the body will tear the costo-clavicular ligament and separate the external epiphysis, but such an elevation cannot occur in the act of delivery. Freeing the arm across the back will put such a strain on the sterno-clavicular ligament that the internal epiphyses will separate. Lateral pressure on the shoulder can fracture the clavicle in its outer third. Strong traction on the head may separate the internal epiphysis by stretching the sterno-cleido-mastoid muscle. Therefore, fracture of the clavicle or separation of its epiphyses may occur in delivery in four ways: First, by direct impact, in delivering the aftercoming head, when the fingers hooked over the shoulder press on the clavicle. Second, by lateral pressure on the shoulder when the accoucheur's hand is pressed up in the narrow space in order to grasp the infant's extended arm, or, having grasped it, by oblique pressure on the humerus. Third, by sweeping the arm across the back. Fourth, by traction on the body to extricate the aftercoming head.

*Humerus.*—The resisting power (tensile strength) of the humerus according to Pajot is 35 kilos; but this force not only separated the epiphyses from the diaphysis, but also tore the soft parts. If laid horizontally on terminal supports, Kuestner found that it would bend in two minutes under a weight of four kilos, the epiphysis would separate without tearing the periosteum under eight kilos, and the bone would snap in two at the point where the weight is hung under 11½ kilos in four minutes. Hence the *locus minoris resistentiæ* is at the junction of the upper epiphysis and diaphysis. Fracture of the humerus occurs exclusively (according to Kuestner) whilst freeing the extended arms in breech presentation. The case of Dr. Godfrey (above cited) shows that it may also be fractured in head presentation by insertion of the finger in the axilla whilst endeavoring to extricate the shoulder.

If after version (as is usually the case) the arms have become extended above the head, they can be freed either by sweeping them in succession over the face or more rarely (when the forearm is caught be-



hind the neck) by sweeping over the back. In sweeping over the face the elbow may catch against the pelvic bones and then the humerus may break. By sweeping across the back either the clavicle or humerus will fracture. In performing this manipulation one may rotate the humerus inwards or outwards. Kuestner made 20 experiments with outward rotation and got separation of the humeral epiphysis 16 times and fracture of the humerus 3 times. In 11 experiments with inward rotation, the epiphysis separated once, the diaphysis fractured twice, the scapula fractured once, and 7 cases were uninjured. Hence, if the arm has to be liberated by sweeping across the back, the humerus should be rotated inwards, though this manipulation has the special disadvantage of pressing on the brachial plexus and causing temporary paralysis.

A real luxation at the shoulder (that is, when the head of the humerus tears through the capsule and leaves its socket) is practically impossible; the epiphysis will sooner separate. But such a separation, especially when the periosteum is torn so that the two parts of the bone are not held in continuity, may be easily mistaken for a dislocation, and the ensuing disability of the arm might be erroneously diagnosed as due to paralysis of the supra-scapular nerve.

*Femur.*—The femur is broken directly by transverse or oblique pressure, and by traction in its longitudinal axis, and indirectly by strain of its ligaments in rotation. The first usually occurs when the finger, the fillet or the blunt hook is used in breech presentation to make traction on the groin. If the force is expended entirely on the short neck of the femur, fracture is very unlikely, but dislocation or separation of the epiphysis may occur. Hence, if the hook is not correctly adjusted, or if traction is not made in the right direction, a fracture will ensue. If, whilst the finger or hook is *in situ*, a pain should suddenly shoot the breech through the narrow pubic arch before the finger can be extricated, the transverse force and the narrower space may cause a fracture. That is what occurred in my case.

In longitudinal traction, Pajot used 63 kilos for nine minutes to loosen the lower epiphysis, but the soft tissues also tore. Kuestner found from 10 to 32 kilos for four minutes sufficient—the range being due to the condition of the several cadavers. When traction is made in the longitudinal axis, any twisting or hyper-extension of the limb causes the injury to occur much more quickly. An infant cadaver inserted in a phantom pelvis withstood a weight hung from the groin of 14 kilos for five minutes; but as soon as the leg was moved a little out of the vertical line the femur snapped 1½ cm. from the great trochanter.

Forty kilos hung for fifteen minutes did not cause a dislocation, but when the hook was so adjusted that the force acted entirely on the short neck of the femur, dislocation quickly followed.

*Tibia and Fibula.*—These bones are seldom exposed during delivery to any other force than traction in their long direction. Kuestner hung 10 kilos to the foot and after four minutes the lower epiphyses of both bones separated, tearing the periosteum, whilst the upper epiphyses were loosened, but the periosteum remained intact. Besides excessive force in a longitudinal direction as a cause of the fracture of these bones, they may also break from transverse pressure of a narrow pubic arch. Such were Von Büngner's and Hoffa's cases of pseudo-arthrosis. But perhaps the most frequent cause of injury to these bones is the manner in which the accoucheur grasps them in order to make traction. If seized with opposing fingers and thumb, transverse pressure, especially when the knees are still caught, may cause separation of epiphysis or green-tree or complete fracture. Kuestner thinks that loosening, if not complete epiphyseal separation, in these bones is far from seldom.

As an ætiological factor, then, force varying in amount, duration, and direction occupies the first place. But resistance which depends on the relative proportions of the child and the maternal pelvis is also to be considered. In his 27 dissections of cases of secondary breech deliveries, Ruge studied out this point. He ascertained that fracture of the clavicle occurred as frequently, whilst rupture of the vertebræ and fractures of the humerus, femur and mandible occurred more frequently in normal pelvis and normal or small children than in small pelvis and large children. Hence it follows that resistance is much less of a factor than force.

Force necessarily accompanies manipulative interference, which occurs either as version, extraction, or liberation of the arms; and of these the act of extraction is the most frequent cause of injury. If it were always remembered that extraction is not a necessary sequence of version, that the indications calling for version do not also require extraction, many accidents would be avoided.

The indications for version are of three classes:

I. Those conditions which demand rapid delivery: (1) Eclampsia, (2) concealed hæmorrhage, (3) placenta previa.

II. Conditions which simply jeopardize the child's life: (4) Face or brow presentation, (5) prolapse of funis, (6) prolapse of arm or foot alongside of head.

III. Conditions which make unaided delivery improbable: (7) High arrest from inertia uteri, large head, constriction of uterus, Bandl's

ring or rigid soft parts, (8) pelvic deformity, (9) transverse presentation.

In only two of these conditions, *viz.*, 1 and 2, is it necessary that extraction should follow version; in 3 complete version is sufficient to stop the hæmorrhage, and in the others either forceps may be used instead of version or version may be avoided by suitable measures. In short, extraction should not follow version if mother and child are doing well, if the funis is all right, and if the presenting breech is not too blue. The completion of the delivery should be left to Nature. But if extraction must be made, the following points are suggested: (1) Traction should be made intermittently, at regular intervals or during the pains. (2) It should be supported by external suprapubic pressure by an assistant. (3) The hands should grasp the foetal parts as near the vulva as possible. When grasping the feet, the heels should lie in the hollow of the hand, the middle finger inserted between the two tibiæ and the other fingers outside the fibulæ. In grasping the legs the thumbs lie parallel along the calves and the fingers along the anterior surface. (4) There should be no twisting, and the direction of traction should be downwards and backwards till the anterior hip is visible, then horizontally with lever movements to lift the posterior hip over the perinæum, and then again backwards to free the anterior hip. (5) The blunt hook should never be used on the living child. Happily, forceps are no more made with one handle terminating in a hook. (6) In liberating the extended arm it should be grasped as near the wrist as possible, because it will thus more easily flex at the elbow. It would be a serious error to grasp it between shoulder and elbow. (7) Sweeping the arm over the back is rarely necessary, but if it is, the humerus should be rotated inwards. (8) The finger should never be inserted in the axilla to help out the shoulder. A soft catheter would be better, but I feel sure that all interference is wrong, for if the head has passed through, the shoulders necessarily must. If one has not patience to wait, changing the position of the mother to the side corresponding to the infant's back may help to dislodge the shoulder. (9) In breech presentation the forceps are safer, quicker, and easier than any other method. (10) Patience is the best of all forceps; but if the woman won't wait and the doctor is in a hurry, steel forceps are sometimes, though rarely, allowable.

But a wise and faithful accoucheur will endeavor during the course of the pregnancy to foresee and anticipate conditions which make manipulative interference necessary. Urinary examinations may forecast eclampsia. In contracted pelvis he will arrange for premature delivery as soon as the child is safely viable, without forgetting the al-



ternative of symphysiotomy. In relaxed abdominal and uterine walls, he will have the woman wear an abdominal supporter so as to limit the movements of the foetus. He will preserve the amnionic sac as long as possible, and if he does puncture it, will do so not at its most dependent part, but laterally as far up as he can, thus avoiding a strong gush of fluid and possible prolapse of the funis. If he must make a version, he will first try posturing and external manipulation. And generally he will not be hasty, but will trust to Nature as long as he has no real indication for interference.

After delivery, the babe should be carefully examined, especially if extraction or liberation of the arms was practised. Too often, fractures, dislocations, or separation of epiphyses pass unnoticed, or if noticed later are attributed to carelessness of the nurse in handling or dressing the child. Smellie is very frank in his admissions in this respect. He concealed the fracture of the humerus which he had made in version, and told the parents that it was "only a slight strain." For the dislocation of the shoulder which he did not recognize for some months after birth he blamed himself bitterly. "It was entirely owing to my neglect in not examining the child after delivery, when the limb might with ease have been reduced. This was a caution to me ever afterward, and should be to every one, to examine carefully the extremities and every part of the child's body after such deliveries." Schatz states that fractures of the clavicle escape recognition because callus forms and crepitation ceases by the third day. If the arm was freed across the back, inward rotation of the humerus will be a sure sign of fracture or epiphyseal separation.

If an injury or dislocation is found, it should be treated according to usual surgical methods, though some modifications must be introduced to suit the condition and needs of the infant, especially in fracture of the femur. The difficulty is to get counter-extension. Smellie advised simple bandaging and placing the child on its side on cushions high enough to reach the mother's breast. Diesterweg used paste-board splints. Credé after several attempts at fixation finally passed a bandage under the knee and kept the thigh flexed against the trunk for fourteen days.

Johnson used an ingenious device for getting extension and counter-extension. He laid the baby on a cushion in a rocking-chair from the back of which several rods had been removed. He suspended the limb, splinted with cardboard, to a rod nailed transversely on the arms of the chair. This apparatus served as a cradle, allowed access to the infant for toilet purposes, and kept the limb immovable.

Detwiler used pasteboard splints with a sodium silicate bandage extending from the feet to the chest. Extension and counter-extension were supplied by a shingle splint and adhesive-plaster strips. Union without deformity occurred in eighteen days. Godfrey treated his case with pasteboard splints, resulting in complete recovery in three months. Ten-Eyck used the same method. Collier not only used external and internal pasteboard splints, but fastened the leg to its fellow. Union was complete on the fifteenth day, and when four and a half years old the child walked without shortening or deformity. I treated my case first with pasteboard splints and plaster bandage, but found it impossible to keep the parts clean. So I flexed the thigh on the abdomen and kept it *in situ* by a plaster bandage around the waist. The mother recently informed me that the broken leg is straighter than the other one.

In discussing Ruge's paper on breech presentations, Martin, Sr., made the following suggestions which are worth quoting:

"1. When the os is fully dilated and the waters have broken, the attendant should with the hand externally hold the child's head against its breast. This helps uterine contraction and keeps the arms folded on the breast, thus avoiding extension.

"2. As soon as the breech is out of the vagina, begin expression, and aid it by downward pressure with the fingers of the other hand on the child's upper jaw.

"3. The fingers on the upper jaw should help turn the head on its longitudinal and transverse axes.

"4. Don't begin expression unless danger to the mother or child is present, as shown by auscultation, pulse rate, funic beat, convulsions, or hæmorrhage.

"5. If expression fail, use the forceps."

In conclusion, I would say that the chief motto of an obstetrician should be *Festina lente*—make haste slowly. Most of the mishaps of obstetrics occur because the physician is led to interfere, his judgment and self-possession being over-powered by the pleadings or scoldings of the parturient woman and her sympathetic friends. Women want babies, but they don't want to pay Nature's price.

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