An Address

ON

INFUNDIBULIN:

THE INDICATIONS FOR ITS USE IN SURGICAL
AND OBSTETRICAL PRACTICE.*

BY

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I WAS much pleased to receive an invitation to address this society on the active principle of the posterior lobe of the pituitary body, for it is now sixteen years since I was responsible for the introduction into clinical practice of this preparation, to which I gave the name "infundibulin."¹ Almost immediately it came into general use throughout the civilized world. Watson, then professor of obstetrics in the University of Toronto, writing in 1913, said:

"It seldom happens that a new drug or remedy comes into universal use in such a short space of time as has been the case with pituitary extract in obstetrical practice. Since it was first used . . . in 1909 it has been employed in practically every obstetrical clinic throughout this continent and in Britain and Europe."²

In these circumstances we may assume that the interval of sixteen years which has elapsed since infundibulin was first employed has been long enough to enable us, not only correctly to appraise the value of this remedial agent in clinical practice, but also to establish the indications for, and contraindications to, its use. During this period the practical applications have been so considerably extended that I was not surprised to be asked to confirm or refute the prevalent belief that the potent properties of this extract are frequently, and quite unconsciously, abused in obstetrical difficulties. I shall deal with this important matter in due course, and shall endeavour to be as definite as possible in the opinions expressed, for it may be that some guidance on the matter is desired by the conscientious practitioner in view of the very general employment of infundibulin, and, possibly, the inaccessibility of the literature in which the chief indications and contraindications have been specifically stated.

HISTORICAL.

The observation by Oliver and Schafer³ in 1895 that an extract of the whole pituitary had a pressor effect upon the blood pressure for some time escaped further recognition and investigation, being overshadowed by the coincidental statement of these investigators that the extract made from the suprarenals was more powerful in this respect. In 1898 Howell⁴ demonstrated the fact that it is the extract of the pars posterior (pars intermedia and pars nervosa) alone that has a pressor action; that prepared from the pars anterior has no such characteristic. Subsequently to 1898 occasional papers appeared in physiological journals dealing for the most part with the action of infundibulin on the cardio-vascular and renal systems.

During the years 1907 and 1908 Hick and I⁵ conducted a series of experiments, an account of which was published early in 1909. Later in the same year the clinical paper, to which reference has already been made, was published. From 1910 onwards there was a deluge of Continental communications on the subject, but practically no new ground was broken. To-day infundibulin is an established agent for the relief of many serious conditions; but before we consider these a brief survey of our physiological knowledge concerning the substance itself may not be out of place.

THE ORIGIN, NATURE, AND DESTINATION OF INFUNDIBULIN.

It will be remembered that all the epithelial elements of the pituitary arise from the ectodermal cells of that upward prolongation of the angle made by the roof of the stomodeum and the pharyngeal membrane, which has come

to be known as Rathke's pouch. The hollow neural process of the diencephalon—the infundibulum—descends to meet this pouch, and is closely applied to the epithelium without the intervention of connective tissue.

The original cavity of Rathke's pouch forms the cleft of the pituitary body, and from the anterior side gland-like diverticula are developed. In this way the pars anterior is formed. The cells on the posterior aspect of the pouch, adjacent and adherent to the pars nervosa, or infundibulum, constitute the pars intermedia. The cells of the pars intermedia have therefore the same origin as those of the pars anterior! This is important; and it is probable that the secretion of the cells of the pars intermedia, like that of the cells of the pars anterior, has no pressor action. The pars posterior, as we have seen, consists of the pars intermedia and pars nervosa; and since separation at the cleft is a simple matter the whole posterior lobe is used as the material from which infundibulin is extracted commercially.

Nevertheless, one of the most interesting problems connected with infundibulin is its origin and destination. Several observers^{6,7} have stated that it is possible in the laboratory more or less completely to separate the pars intermedia from the pars nervosa, and that an extract made from the nervous portion gives all the typical reactions of infundibulin, whereas one made from the cells of the pars intermedia is comparatively inert. Other observers⁸ have obtained exactly contrary results; but most investigators have confirmed the work of Osborne and Vincent. This subject and the inherent difficulties surrounding the complete separation of the two parts are discussed in my work on the pituitary.⁹

It may, however, be accepted that although the pars intermedia has a definite secretion of its own, which is sometimes granular, sometimes colloid, and about which we know very little, yet, on the other hand, some of the adjacent cells of the pars intermedia and their secretion pass into the pars nervosa—which is structurally composed of neuroglial cells and fibres—and there undergo alteration: the nuclei disappear from the cells, the cytoplasm forms a mass of granular substance, resembling the aggregations of granular secretion formed from the cells in the pars intermedia, and infundibulin is produced.

According to Herring¹⁰ and others, the pars intermedia cells and the granular secretion pass through the pars nervosa to the central cavity, if there be one,* but in any case reach the third ventricle. I have never been able, on the evidence adduced, to satisfy myself of this as an inevitable or even usual sequence. The fact that pressor substances have been found in the cerebro-spinal fluid is not conclusive. My own view is that the secretion from the pars intermedia which passes into the pars nervosa is altered there, and normally is taken up as fully formed infundibulin by the numerous thin-walled vessels present in the pars nervosa. The chemical nature of infundibulin has not been established.

Pressor Action of Infundibulin.

Infundibulin has a most characteristic pressor action on all involuntary muscle, including the heart muscle; moreover, it affects the involuntary muscle fibres that may be scattered through such organs as the spleen and mammary glands. The effects with which we are immediately concerned are those produced on the cardio-vascular system, the alimentary tract, the uterus, and the bladder. A feature common to all is that the result obtained is more pronounced when there is atony of the muscle. Further, it is an interesting fact that the pressor action of infundibulin is maintained for a longer period of time than is the case with suprarenalin.

METHODS OF ADMINISTRATION.

The mode of administration of any drug or extract is a matter of considerable moment, yet it is surprising how thoughtless many are in regard to this matter. The method of election is based on a knowledge of certain fundamental particulars; for example, it is useless to give suprarenalin by the mouth, for it is destroyed by the gastric juices; on

* The central cavity of the infundibulum persists in some mammals—for example, the cat—but is completely obliterated in many, including the primates.

* Delivered to the Northern Counties Medical Society, Newcastle-on-Tyne.

the other hand, we believe that these digestive secretions have no destructive action on infundibulin. Nevertheless, in surgical and obstetrical conditions in which an immediate pressor effect is required it would be absurd to administer pituitary extract by the mouth, although such a procedure may be useful in the treatment of metabolic disorders coming under the care of a physician.

Again, how frequently is the practice adopted of administering infundibulin hypodermically, in spite of the fact that it has been demonstrated repeatedly that the effect obtained by this method is much slower and much less pronounced than that which follows intramuscular and intravenous injections. It is probable that all the unsatisfactory results that have been reported in regard to the pressor action of infundibulin have been due to a wrong method of introduction, generally hypodermic, and to the use of badly prepared products. The former source of dissatisfaction is easily remedied in surgical and obstetrical work: the extract must always be given intramuscularly or intravenously. I find the triceps the most convenient muscle for the purpose.

Standardization of Infundibulin.

In respect of the efficiency of the preparations used therapeutically we are entirely in the hands of the manufacturing chemists, some of whom, no doubt, may shelter themselves behind the recognized difficulties of exact standardization of organic extracts of unknown composition. Still, it is certain that some preparations are comparatively inert, and others more active than the average. The liquid extract, as usually prepared, is stated to be of a strength of 20 per cent.—that is to say, 0.2 gram of fresh pars posterior is extracted with 1 c.cm. of saline solution. The albuminous matter is removed, and the preparation is sterilized by filtration through unglazed porcelain.

In the past the method usually adopted for standardization, if so it can be called, has been the reaction to the preparation of infundibulin of a strip of uterine muscle from one of the lower animals. As there are generic and seasonal variations in the reactivity of this muscle, the results obtained are not likely to be delicate or conclusive.

The chromatophore reaction in amphibia, described by Hogben and Winton in a series of papers, is hardly likely to prove more than an extremely sensitive qualitative indication of the presence of infundibulin, if, indeed, it prove to be a specific reaction. A quantitative method of standardization is required, and this cannot readily be obtained until we know the chemical formula of infundibulin. Accurate dosage will then be a simple matter.

It appears possible that some persons are more susceptible to the action of infundibulin than others; yet it is difficult to estimate such an idiosyncrasy, which may be nothing more than a local expression of the degree of the involuntary muscle paresis for which the preparation has been administered.

I propose here to confine my attention entirely to the use of infundibulin in surgical and obstetrical practice, and to say nothing of the many conditions in which its properties have been utilized by the gynaecologist and physician.

GENERAL CONTRAINDICATIONS TO THE USE OF INFUNDIBULIN.

Infundibulin should not be administered during an operation if there be respiratory failure, for the normal amplitude of respiratory movements is diminished by the extract.

When there is myocardial or valvular disease of the heart without complete compensation infundibulin is absolutely contraindicated. A fatal issue may follow the exhibition of a small dose. Even in the presence of compensation it is a dangerous drug to employ.

In renal disease associated with a high blood pressure the use of infundibulin is inadvisable.

The special contraindications which apply to the stimulation of intestinal and uterine muscle will be specified in the appropriate places.

INDICATIONS FOR AND CONTRAINDICATIONS TO THE USE OF INFUNDIBULIN IN SURGICAL PRACTICE.

The Prevention and Treatment of Shock.

Shock, as is well known, may be caused by trauma and loss of blood, alone or together; by toxæmias, bacterial and chemical; and by violent psychical disturbances. It is generally agreed that in this state the systolic blood pressure is reduced—that is, there is loss of tone in the unstriated muscle tissue. As indicated, the production of a low blood pressure by one of the causes mentioned, although insufficient, perhaps, to produce a definite degree of shock, may, when associated with another of the causes, also acting in a minor degree, lead to the establishment of this state by a summation of effects.

Now, in the prevention of shock much can be done by the use of infundibulin in debilitated patients with low blood pressure. The administration of this extract several times each day for several days before a serious operation, undertaken in septic or cachectic cases, often enables the patient to withstand the traumatic effects of operation and the toxæmic effects of the anaesthetic.

Many surgeons at the present time adopt the precaution during an operation of any magnitude of having the blood pressure recorded every few minutes. For a number of years my anaesthetist has made a routine practice of this procedure, and I am sure he would bear me out when I say that it has often given him warning that the patient's condition is deteriorating many minutes before any other evidence was available. In such circumstances an injection of infundibulin may save the situation.

In a city so near the Scottish border I am perhaps on dangerous ground when I say that chloroform is not only more hæmolytic, and more conducive to acidosis, than ether, but also has a more immediate and serious effect on the blood pressure. Infundibulin will do much to mitigate the last, but intelligent co-operation to simplify the work demanded of it is not to be despised. So, too, in regard to shock associated with loss of blood: it is clear that to raise the tone of muscle in empty vessels is a futile procedure, but that the maintenance of tone after the transfusion of blood or other colloid preparation is of the utmost importance. As stated, infundibulin raises the tone of hypotonic unstriated muscle to a far greater degree than is the case when the tone is normal.

Infundibulin, then, is of inestimable value in the treatment of shock, provided it is used with an intelligent appreciation of the nature of the condition, and of the factors concerned in the production of it.

The Prevention and Treatment of Post-operative Gastric and Intestinal Atony.

Few surgeons have not been faced with the problem of intestinal atony following abdominal operations. So common has been this complication that in some clinics the routine injection of infundibulin at stated intervals after operation is practised, in order to prevent ileus supervening. I do not think this should be necessary in "clean" cases; but much depends on the way in which the intestines and peritoneum are protected from injury and are treated during the operation. It will be generally agreed that to-day the technique of intra-abdominal interference in such patients has reduced the appearance of this distressing complication almost to vanishing point.

In septic cases, and in those in which there has been a certain amount of trauma in the separation of adhesions, which should be divided with sharp scissors or a knife whenever possible, paralytic distension is not infrequently encountered; and in them the preventive use of infundibulin, by means of intramuscular injections of 0.5 c.cm. every few hours, should form a regular part of the after-treatment of the patient. Should distension be already present when the matter is taken in hand, it is advisable that, ten minutes after an intramuscular injection of infundibulin, which sensitizes the intestinal musculature, a turpentine enema should be given slowly by means of a catheter and funnel.

In order to obtain a certain pressor effect on the intestinal muscle it is essential that a large dose be administered—namely, 1 c.cm. This dose followed by a turpentine enema

often gives a dramatic result. Similarly, in the rare condition of acute dilatation of the stomach, this organ should be washed out ten minutes after infundibulin has been injected.

The use of infundibulin in these complications is contraindicated if an operation involving repair or anastomosis of the stomach or intestines has been performed, and, of course, if unrelieved obstruction be present.

Vesical Atony.

When there is atony of the musculature of the bladder with distension a pressor effect and evacuation may follow an injection of infundibulin, but this result is somewhat uncertain.

After some gynaecological operations, and after parturition, it is not unusual for a patient to be unable to evacuate the bladder unaided. With good nursing and a proper use of the catheter it is rare for any protracted disability to occur. If, however, the patient be not carefully watched, there is always the possibility of an "overfull bladder"—paralytic distension, with overflow.

The inability voluntarily to empty the bladder can generally be overcome by the judicious use of infundibulin and a catheter. The bladder is allowed to become full to the normal extent, an injection of 1 c.cm. of the liquid extract is then given, and ten minutes later a small catheter is passed. When the flow commences the catheter is withdrawn, and in many cases micturition will continue naturally. Although this by no means always happens, and it may be necessary to repeat the procedure a number of times, I think it should be tried, for the long-continued invalidism that may follow vesical paresis cannot be lightly regarded.

INDICATIONS FOR AND CONTRAINDICATIONS TO THE USE OF INFUNDIBULIN IN OBSTETRICAL PRACTICE.

I do not propose to discuss the stimulation of uterine contractions in relation to abortion beyond saying that pituitary extract is not an abortifacient in the presence of a live foetus. When that period of gestation at which the foetus is viable has been reached, this extract becomes a most potent agent which may be used to the advantage or disadvantage of the patient.

Induction of Labour.

So far as the use of infundibulin is concerned for the termination of pregnancy, the indications may be classified as follows:

- (a) For the expulsion of a dead child.
- (b) In order to obviate the possibility of disproportion between the maternal and foetal parts.
- (c) In the treatment of ante-partum haemorrhage.

In the first and second groups there is usually no urgency, and induction can be planned to suit the circumstances of the case. Infundibulin administered every four hours for several days in doses represented by 0.5 c.cm. of the liquid extract occasionally precipitates labour; but such an event is comparatively rare unless the patient be at term or the child is dead.

In those cases in which the dates and examination of the uterus and foetus reveal full-term pregnancy, and in which there is a strong probability of post-maturity, it is a very wise procedure to administer the extract as indicated. Labour in these circumstances often follows. If it does not, and in all ordinary cases in which induction at the thirty-sixth or thirty-seventh week is desired, the administration of infundibulin four or more times in each twenty-four hours for three days should be followed by the insertion of bougies, and after this the injections should be continued if labour does not supervene before the next dose is due. The uterus has been rendered so sensitive by the extract that the mechanical irritation of the bougies is greatly enhanced, and labour usually supervenes within a few hours.¹¹

In the treatment of ante-partum haemorrhage infundibulin plays an important role. It is recognized by all obstetricians that the first method of treatment in cases of *accidental haemorrhage* in which the bleeding is not entirely

concealed, and in which there are indications for interference, consists of rupture of the membranes and an intramuscular injection of infundibulin. Whether the foetus be at full term or premature does not matter, provided there are no general contraindications to the use of infundibulin. With regard to accidental haemorrhage which is entirely concealed, infundibulin should not be employed until the uterus has been emptied. Even then the response will depend on the state of the uterine musculature.

In placenta praevia, especially when the implantation is not central, infundibulin may form a valuable adjunct to other methods of treatment, such as rupture of the membranes. There is no specific danger whatsoever in the judicious use of infundibulin before labour has started, for, although subsequently labour pains may be strong, in my experience there has never been any evidence of excessive expulsive force.

Caesarean Section.

The question now naturally arises as to the use of infundibulin after Caesarean section. In ordinary cases an injection of 0.5 c.cm. of the liquid extract should be made into the triceps of the patient *after the uterine wound has been sutured*, if retraction appears then to be incomplete. When an injection is given before the uterus has been sutured, especially if it be given into the uterine muscle, it may be almost impossible properly to approximate the incised muscle wall of the uterus.

When, however, Caesarean section has been performed for concealed accidental haemorrhage and the uterus has been preserved, infundibulin should be injected directly into that organ. In these circumstances numerous injections of a few cubic millimetres should be made in various parts of the uterine wall. As already indicated, the result will, however, depend in a great measure on the damage sustained by the muscle bundles, among which scattered effusions of blood are often found.

Uterine Inertia.

A glance through standard textbooks is sufficient to indicate how limited has been the study, and consequently how incomplete is our knowledge, of uterine inertia. Some authors show an inclination to consider "primary" and "secondary" inertia as dissimilar phenomena, and not, as they really are, similar phenomena relative to time and space.

Until such time as the whole question has been made clear by the closer consideration of the chemical stimuli and reflex inhibitions involved, and in order to avoid complicating matters, it may be advisable to adhere to the classification universally adopted and to consider uterine inertia under the usual headings.

"Primary" Uterine Inertia.

"Primary uterine inertia" is the term applied to uterine inertia occurring before the second stage of labour. In order properly to explain the most useful role played by infundibulin in primary uterine inertia of a pathological type, it is important that I should make a few remarks on primary inertia in general.

Primary uterine inertia is of two kinds—physiological and pathological.

Physiological primary uterine inertia is a merciful and advantageous natural phenomenon. I believe it to be of a reflex and inhibitional character—that is to say, owing to some unusual and generally more or less obstructive condition, such as occipito-posterior presentation in a primigravida, for a long time the uterine contractions are feeble. I would, indeed, go further, and say that the inherent factor responsible for the weak pains of the normal first stage, especially in the primigravida, is the relatively obstructive condition of the incompletely dilated cervix. It is not, in fact, the weak contractions that are responsible for the slow dilatation of the os, but rather it is that the undilated os reflexly inhibits the uterine contractions. This may, by those who do not follow my reasoning closely, be regarded as splitting straws, but it is not so in reality, as that which follows will demonstrate.

In the first place, the blood pressure may be high. Secondly, if an injection of infundibulin be given in such

circumstances, this is not always followed by an increase in the expulsive contractions, although the tone of the uterine muscle is raised; but once the cervix is fully dilated, or almost fully dilated, the contractions may become in these circumstances dangerously violent. Nevertheless, in primary uterine inertia of the physiological type, although Nature will do her best to thwart our evil designs, we should never administer infundibulin, for it is not required, and, unless the diagnosis be accurate, serious trouble may follow.

Pathological primary uterine inertia, as is well known, may be due to inherent pathological conditions of the uterine musculature caused by multiparity, overdistension of the uterus from various causes, fibromyomata, and the rest; but with these I am not at the moment concerned. I refer rather to that form of primary uterine inertia which is associated with a normal uterine musculature; I mean the inertia that is due to an insufficiency of pressor substances in the blood. It is commonly believed that in these circumstances the output of infundibulin is insufficient.

This is a subject in which I have been much interested since I first drew attention to the importance of the diagnosis and treatment.¹¹ A bad obstetrical history of patients, who have quite evidently suffered with primary uterine inertia in previous labours, is frequently forthcoming, and I have seen more than one patient on whom Caesarean section has been performed for this condition. It is, however, most important that it should be recognized, if present, as it often is, during the first pregnancy, for not infrequently primary uterine inertia due to the cause under consideration dogs a woman throughout her obstetrical career.

Pathological primary uterine inertia of this type is definitely recognizable before labour commences, and should therefore be excluded, or its presence proved, in every pregnant woman during the last two weeks of gestation. When the patient is examined at this period, in normal circumstances palpation of the uterus through the abdominal wall and traction on the nipples excite painless but very definite contractions; during the period of relaxation the tone of the uterus is found to be good. If now the systolic blood pressure be recorded, it will be found to be above the average for non-pregnant normal women of the same age as that of the patient. When labour is due the blood pressure is often considerably raised.

On the other hand, in women in whom there is impending uterine inertia, it will be observed either that it is impossible to elicit uterine contractions at all, or that, when aroused, they are feeble and fleeting. Moreover, in quiescence the uterus feels flabby and atonic on abdominal palpation. The systolic blood pressure in these circumstances is found to be reduced to the equivalent of 110 mm. of mercury, or even less. I have therefore treated cases of primary pathological inertia of this type with infundibulin whenever the condition has been recognized and checked by a blood pressure reading—a method of corroboration that is always essential. The success of this treatment has been most encouraging. I regret that time will not allow me to record in detail some of the cases I have had under my care.

In such circumstances 0.5 c.cm. of the liquid extract is administered intramuscularly two or three times every day, according to the interval before labour is due. When a patient has been treated in this way before the onset of labour, it is usually quite unnecessary to administer any more of the extract during subsequent parturition, for the pains are then strong and forcible. If, however, the uterine contractions should become weak, there is no reason why infundibulin should not again be employed, provided the patient is multiparous and there are no contraindications, general or local.

In those other, not uncommon, instances to which reference has been made, of pathological primary inertia due to local anomalies, rather than to insufficiency of pressor substances in the blood, we are concerned with an abnormal condition of the muscular tissue due to various causes. I do not propose to consider the rarer of these; it will be enough to refer only to the effects produced by multiparity, and by overstretching of the muscle fibres by hydramnios

and multiple pregnancy. In such circumstances the muscle does not respond to stimuli so forcibly as the normal tissue; consequently stimulation must be greater. In the absence of contraindications, and although the blood pressure be normal, the fluid extract may therefore be administered in small doses under careful observation, after labour has started.

"Secondary" Uterine Inertia.

"Secondary uterine inertia" is the term employed to denote an absence, or diminution in the efficiency, during labour of the uterine contractions, which previously had been normal. Secondary inertia may be due to the same causes as those responsible for primary inertia.

It is clear that in those cases in which the musculature is abnormal owing to multiparity and other causes the inertia is primary in origin, although possibly the contractions may have been strong enough to carry labour unaided through the first stage. It is unnecessary further to consider the treatment in such cases.

Strictly speaking, as I have indicated in my definition, the term "secondary inertia" implies a temporary failure of the uterine muscle to continue contracting normally. Now, it is usually stated that this is due to *exhaustion of the uterine muscle*. Can we be satisfied with this explanation, which, after all, had its origin in the distant past? I do not think there are inherent structural quantitative differences in the musculature of the uterus in different women of the same age, such as may be seen, for instance, in the skeletal muscles. Any differences that obtain are the result of local lesions, to which I have referred, or to constitutional conditions, which no doubt also influence the availability of pressor substances.

I believe that the usual form of secondary inertia is that which supervenes during a protracted labour: gradually the uterine contractions diminish in frequency and force as the result of exhaustion of the pressor substance in the blood. The condition is probably not due to exhaustion of muscle fibres in the uterus, for with muscle fatigue further stimulation creates no response, whereas in these cases a response is always obtainable by means of infundibulin. Confirmatory evidence of this view is found in the lowered blood pressure associated with secondary uterine inertia. In the presence of a sufficiency of pressor substances, if the labour be obstructed, an irritable condition of the muscle supervenes, and this may terminate in tonic contraction, especially when mechanical stimulation, in the form of operative interference, is superadded.

I have gone at some length into this matter because it is the realization of these points that makes it possible for us to state definitely the indication for the use of infundibulin during labour, and to emphasize the serious contraindications the neglect of which has led to many grave disasters. Before infundibulin is given during labour the accoucheur must have informed himself quite clearly that the contraindications to the use of this preparation are absent, and that the indication for it is beyond reasonable doubt.

Indication for the Use of Infundibulin during Labour.

The only scientific indication for the use of infundibulin during labour is the evidence, readily obtainable, of insufficiency of this substance in the blood. This evidence consists of a history of protracted labour, during which the previously normal contractions gradually diminished in force and frequency, and the state of the blood pressure. I have nothing to say against the practice of administering soporifics and of allowing the patient to recuperate. In many cases this is advisable. During the period of rest the pressor substances reaccumulate in the blood, and labour may terminate naturally. When, however, the head is low in the pelvis, and the pains cease for a long period of time, then, all else being equal, the best interests of the patient and child are served by the administration of infundibulin. So, too, when there has been inertia throughout the whole course of labour, this disability may be successfully treated by occasional injections of infundibular extract.

The question of dosage is of some moment. It is advisable during labour never to administer as an initial dose a greater quantity than 0.25 c.cm. intramuscularly. In a majority of

cases it will be found that this dose is quite effectual. It may, however, safely be repeated after an interval of two hours. If this small dose appears to have but little effect, then 0.5 c.cm. may be injected on the next occasion, but this quantity should not be exceeded.

Contraindications to the Use of Infundibulin during Labour.

The contraindications to the use of infundibular extract during labour are very clearly defined. In the first place, any disproportion between the foetal and maternal parts absolutely prohibits the exhibition of this preparation. Even though there be inertia due to prolonged labour, and a low blood pressure, indicating the exhaustion of pressor substances from the blood, infundibulin should not be given. To do so in the presence of recognizable disproportion is to run the grave risk of rupture of the uterus.

With respect to the statement made concerning arrest of the head when low in the pelvis, the frequency of such an occurrence due to contraction of the pelvic outlet must be remembered, otherwise a disaster may follow the use of infundibulin. The fact, too, that there is always relative disproportion in primigravidae, owing to the rigidity of the soft parts, must be borne in mind, and grave consideration must always be given to the question of employing infundibulin, which may lead to precipitate delivery with extensive lacerations of the maternal tissues, if not to rupture of the uterus.

Secondly, the presence of efficient uterine contractions is an absolute contraindication to the employment of infundibulin, for if in these circumstances no progress is made, obstruction, relative or absolute, exists.

It will be evident, then, that infundibulin must be used with extreme caution during labour. The scientific indication must be established, and the contraindications excluded with certainty. Moreover, it is a very sound rule that when forceps are indicated infundibulin is contraindicated, and this in spite of the invitation to us, published in press advertisements, to leave forceps at home and try somebody's specially potent brand of extract.

I have heard of so many cases in which the uterus has been ruptured as the result of the injudicious use of infundibulin—cases of this kind are rarely published—that sometimes I feel inclined to revert to the declaration made in my first paper, that infundibulin should not be used during labour. Yet to do so would be wrong; properly used, infundibulin, with its power of producing regular, rhythmical, and forcible uterine contractions in the absence of a sufficiency of pressor substances, and when the uterine musculature is deficient, may be a most valuable and beneficent agent in the hands of a careful accoucheur.

There is no one, I take it, who seriously doubts that the general use of infundibulin to terminate labour is as culpable as the indiscriminate application of forceps for the same time-saving purpose.

Third Stage of Labour.

The routine use of infundibulin as soon as the second stage of labour is over, to promote expulsion of the placenta, and to hasten the third stage, has been advocated.¹² I do not, however, regard such a procedure as either scientific or expedient when the labour up to this point has been normal, especially when there has been no inertia. If the placenta has been retained in these circumstances it is generally adherent, and the administration of infundibulin may cause the uterus to contract down upon it, rendering subsequent removal difficult. I have seen such cases myself, and I believe that this is what has happened in those instances that have been recorded of so-called hour-glass contraction of the uterus after delivery of the child. If, however, there has been inertia, or a long anaesthesia with the abolition of efficient contractions of the uterus, it is often wise to give infundibulin after the birth of the child, if it has not been given as an aid to delivery.

Infundibulin may be most advantageously employed after expulsion of the placenta, when uterine inertia has permitted post-partum haemorrhage. In these circumstances it is advisable to follow the intramuscular injection of 0.5 c.cm., or the intravenous injection of 0.25 c.cm. of the liquid extract in a little saline, by an intramuscular injection

of ergotin, the efficacy of which is increased by the previous administration of infundibulin.

Subinvolution of the Uterus.

During the puerperium and in the subsequent weeks subinvolution of the uterus may be effectually treated by the administration of infundibulin. It is obvious that the sooner intramuscular injections are given, once the condition has been recognized, the better will be the result.

In conclusion, I would urge that infundibulin must always be employed with care, and with a due regard to the scientific indications in every case. The greatest harm and the gravest disasters have occurred in obstetrical practice from the injudicious use of this potent substance during labour.

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THE TREATMENT OF CONGENITAL CLUB-FOOT.

BY

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THE treatment of congenital club-foot must commence from the moment of birth, when the structures in the foot are soft and pliable, and little pain or shock is experienced by the infant.

There are four principal varieties of congenital club-foot: talipes equino-varus, equino-valgus, calcaneo-valgus, and calcaneo-varus; a less common deformity which sometimes requires treatment is mid-tarsal varus.

The principles of treatment are to stretch the contracted structures causing the deformity, and to relax and then educate those muscles which will restore the muscle balance of the foot. The usual methods are by splinting with malleable iron, by adhesive strapping, by plaster-of-Paris, by club-foot tin shoe, and by operation (Thomas wrench, etc.).

To simplify description it will be assumed that the deformity is talipes equino-varus. The objective is to untwist each part of the deformity in turn—first the varus and then the equinus deformity. The correction of the deformity is not, however, sufficient. The overstretched muscles, which probably have never functioned correctly, must be stimulated and trained to contract along their proper lines of action—for example, the peronei must be made (by tickling the sole) to evert the foot. Later, as the child grows, it can be taught to evert and dorsiflex the foot voluntarily. From this moment it is allowed to walk.

The exact method of splinting employed is immaterial. The important thing is attention to the detail of its application by the same operator throughout the treatment.

1. Malleable Iron.

This material is five-eighths of an inch wide and No. 18 gauge. Each splint should extend from above the knee to below the toes, be well padded on one side, and covered with jaconet.

The varus deformity is manipulated with the fingers until, if possible, only the equinus deformity is left. The limb is then covered with cotton-wool from above the knee to well below the toes, and the upper part of this secured in position with a few turns of special linen bandage. The foot is then held plantar-flexed and everted as much as possible, the malleable iron splint shaped to this deformity, and then placed along the outside of the leg and foot, and bandaged on with the same linen bandage from above downwards and from within outwards. The circulation is watched, and after twenty minutes the infant may be sent home, provided the colour of the toes is pink. This treatment is repeated daily until full eversion, voluntary and sustained, is produced.