

THE PRESENT-DAY STATUS OF THE CONSTRICTION RINGS OF LABOUR

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In spite of the noteworthy advances in most obstetrical fields during the past two decades, one of the subjects which still remains highly speculative is the physiology of uterine-muscle contractility. The aetiology of constriction-ring dystocia is closely linked with the physiology of uterine action, and it is for this reason that it remains obscure, with the treatment unsatisfactory. On the surface it would appear that the management of this condition is straightforward, but any complacency that exists will soon be dispelled by a glance at the appallingly high foetal and maternal mortality and morbidity rates. A review of the subject was undertaken to try to assess the correct lines of treatment when faced with this not uncommon condition.

Definition

The term constriction ring refers to an abnormality of uterine contractility during labour either due to, or responsible for, the production of a ridge of uterine muscle, which is circular or nearly so, and which projects into the uterine cavity or disturbs its normal shape.

Incidence

The estimations vary, but the incidence of this condition is probably nearer 0.1%¹ than 1%^{2,3} of all labours. Primigravidae, multigravidae and grande-multiparae may all be affected.

TYPES

Rudolph⁴ has divided these rings into 2 varieties:

1. *Reversible*. This is simply a spasm affecting a localized circular area of the muscle of the uterus (Fig. 1). It can develop quite quickly following intra-uterine manipulation, or the administration of oxytocic drugs in the presence of hypertonus. This is the type of ring which should in theory respond to conservative measures.

2. *Irreversible*. Here there is a thick localized ridge of uterine muscle which projects into the cavity of the uterus and grips the foetus (Fig. 2). The upper segment is thinned out from the uterine fundus towards the ring, and the lower segment usually presents the same appearance. It would seem that this type of ring usually occurs in association with abnormal uterine action and is demonstrable at Caesarean section. It persists even after death as shown by Phillips⁵ and

Louw.⁶ Phillips regards this condition as the end-result of a colicky uterus in an extreme degree, where the spasm assumes an annular distribution.

In a review of 371 cases collected from the literature, Rudolph⁴ further subdivided these constriction rings into:

A. *Those palpable internally* (91%).

1. Around the baby's neck, behind the symphysis pubis (75%).

2. Around the baby's body, above the symphysis pubis (16%).

3. In front of the presenting part, behind the symphysis pubis (9%).

B. *Those palpable externally* (9%).

Sites

(a) *The junction of the upper and the lower segments*. This is the commonest site, and here it is important to distinguish between a constriction ring and a Bandl's ring or retraction ring (Fig. 3). A retraction ring is the normal demarcation between the upper and lower segments that can be felt from time to time as a slight ring-like elevation in the cavity of the uterus.

(b) *In the upper segment*. These rings have been described as occurring most commonly around the infant's neck, waist, or limbs, but it is conceivable that they arise anywhere in the upper segment due to contraction of the circular muscle fibres over a point of slight resistance.

(c) *In the lower segment*. This is a rare site for the occurrence of constriction rings, and some doubt has been cast on whether they arise here at all.

It is also worth remembering that the ring may be better developed either on the left or right,^{6,7} or even anteriorly or posteriorly. That more than one site may be affected simultaneously has also been shown.

AETIOLOGY

As has been pointed out, the disturbance is basically one of uterine function in labour, which results in the constriction of an area of circular muscle fibres. This may occur at various levels in the uterus.

Rudolph and Ivy^{4,8} demonstrated that physiological constriction rings form in the uteri of pluriparous animals, where the foetus is contained in segments of the two uterine

horns. These horns are the counterpart of the upper uterine segment in the human. The rings, by the very nature of their function, are situated at the junction of the upper and lower uterine segments, and in the upper uterine segment. Furthermore, Ivy, Hartmann and Koff⁹ have shown that the normal contraction wave can be reversed by stimulating the lower segment in the monkey. From these observations they have suggested that under certain conditions atavistic tendencies are exhibited by the uterine musculature, and that these rings are then formed at the corresponding sites in the human uterus.

Stress, resulting from inadequate or improper preparation for pregnancy and labour, may produce conditions favourable for the formation of a ring. Against this argument, however, is the well-documented fact that some patients who are frightened and totally unprepared have short and uncomplicated deliveries, while placid and apparently calm individuals can, and not infrequently do, have any of the forms of incoordinate uterine action. The exact mechanism whereby emotional factors influence uterine action is not known, but the most likely is by sympathetic nervous impulses, or by the action of adrenaline liberated by the adrenal medulla. Although there may be some degree of psychological control of uterine action, it does not seem to be the only operative factor.

Early rupture of the membranes, intra-uterine manipulations, and oxytocic drugs have been cited as factors causing this condition. It is possible that they are predisposing factors, but labour is frequently induced by just these means without causing ring formation.

Cephalopelvic disproportion is neither an active nor a predisposing factor, but the two conditions may exist simultaneously.

In summary, it would seem at this stage of our knowledge that the constriction ring is a primary functional disturbance of the uterus. It is probable that more than one factor may be operative, such as some form of physical interference in a psychologically unstable person, as suggested by Louw.⁶ It is possible that the sites of constriction are based on an atavistic inheritance from the uterus of rodentia, carnivora and ungulata. The physiology of smooth muscle and of the factors controlling labour hold the key to the solution of this problem.

DIAGNOSIS

It is rare for the diagnosis to be made in the first stage of labour;¹⁰ as a rule it is finally made only on vaginal or intra-uterine examination. There are, however, a number of pointers which, if taken into account as soon as they arise, will lead to the suspicion that all is not well. The appropriate examination will disclose the diagnosis, and thus the correct treatment can be instituted at the earliest possible time.

Symptoms

1. The manifestation by the patient of a decided change in her response to uterine contractions during the course of a normal, but prolonged labour. She complains of severe pain over the upper part of the uterus and senses that her pains are not effective.

2. Multigravidae may observe that the contractions differ from those of previous labours and that the pain starts before the onset of the contraction and persists after its cessation.

3. Backache, rectal pain, and pressure are often prominent when the constriction ring is low down.

Signs

1. A depression at the site of the ring may be seen and felt, particularly in a thin patient.

2. The upper segment is said to be circular and the lower cylindrical.

3. Often the diagnosis is made when forceps are applied and the baby cannot be delivered even with strong traction. The head will then be seen to recede quickly after each traction with the forceps. Sometimes the ring will be found when some intra-uterine manipulation is attempted, e.g. an internal version.

4. A definite diagnosis is made only on vaginal examination or even on intra-uterine examination. The following features are found:

(a) There is no descent of the presenting part during uterine contractions; in fact the presenting part often appears to recede with each contraction.

(b) The presenting part is loose in the pelvic cavity during and between contractions.¹¹

(c) There is little or no caput succidaneum formation or moulding of the foetal skull.

(d) The cervix is thick and hangs loose, 'like a curtain' in the vaginal vault. It is not well applied to the presenting part.

(e) Owing to laxity of the cervix, a hand can often be passed upwards into the uterine cavity to palpate the ring.

Constant awareness that the condition does occur, is the single most important factor in early diagnosis, as in all other complications of pregnancy and labour that are not common.

The following case summaries illustrate the above features:

Case 1

Mrs. K. O'H., a 20-year-old primigravida, was admitted in labour, having had no antenatal care. She had been in the second stage of labour for 2 hours, with no advance of the presenting vertex. The cervix was found to be fully dilated and the vertex was 1 cm. below the ischial spines, but appeared to recede with each contraction. There was no moulding, but a small amount of caput formation was present. Under a general anaesthetic a constriction ring was found around the infant's neck, Neville Barnes forceps were applied, and inhalations of amyl nitrite were given. With minimal traction, a live male infant, weighing 7 lb. 9 oz., was delivered.

Case 2

Mrs. S. F., an 18-year-old, booked primigravida, was admitted in labour at term. The membranes had ruptured at the onset of labour, and she continued in an ineffectual type of labour for 72 hours, during which time the cervix dilated to 2 fingers. A deep depression now became visible and palpable above the symphysis pubis. In spite of conservative measures, the ring persisted, and at Caesarean section a live infant weighing 8 lb. 1 oz. was delivered. The ring was still present at operation.

Case 3

Mrs. L. M., a 29-year-old gravida 5, para 4, was admitted in labour at term. All her previous labours had been normal and she had been booked for delivery in the district. After 12 hours in labour the cervix was 4 fingers' dilated, but a deep depression was noted at the level of the umbilicus. The vertex receded with contractions and the cervix was thick and poorly applied to the head. Conservative measures had no effect on the ring and at Caesarean section a live female infant weighing 9 lb. was delivered. A classical Caesarean section was necessary in order to sever the ring and free the baby.

Case 4

Mrs. J. D., a 36-year-old gravida 10, para 8, was admitted at term as a non-booked case after having been in labour for 13 hours. Examination revealed a shoulder presentation, with the membranes

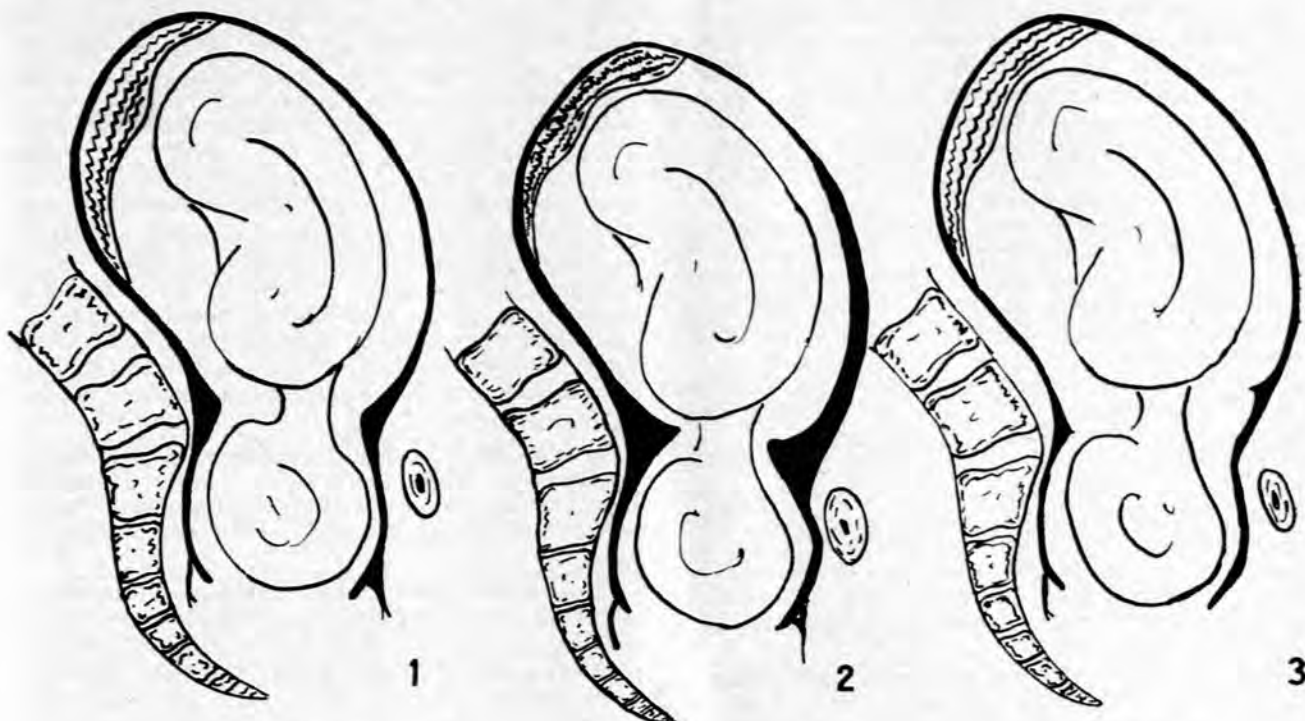


Fig. 1. Reversible constriction ring.

Fig. 2. Irreversible constriction ring.

Fig. 3. Bandl's ring.

intact and the cervix almost fully dilated. Under a general anaesthetic an internal version was performed and, since the cervix was now fully dilated, a breech extraction was commenced. Difficulty was experienced after bringing down a leg, and on internal palpation a tight constriction ring was felt below the breech and around the leg which had been brought down. In spite of amyl nitrite and deep chloroform anaesthesia, the ring remained and was still present at Caesarean section when a live male infant weighing 7 lb. 3 oz. was delivered.

Case 5

Mrs. K. D., a 33-year-old gravida 3, para 1, was admitted as a booked case at 36 weeks for the treatment of pre-eclampsia. She did not respond to the treatment prescribed, and it was decided after 1 week to terminate the pregnancy. Labour was induced by a combination of medical and surgical inductions, followed 12 hours later by a pitocin drip. After 28 hours of poor labour, the cervix was fully dilated, but there was no advance of the presenting vertex, which in fact appeared to recede with each contraction. Under a general anaesthetic a constriction ring was found around the infant's waist, amyl nitrite inhalations were given, and an easy forceps delivery of a 5 lb. 5 oz. female infant was performed.

PROGNOSIS

In 1935 Rudolph⁴ collected 371 reported cases from the literature. The maternal mortality was 15% and the foetal mortality 46%. In no less than 97% was some form of operative interference necessary. The reported maternal mortality varies between 10 and 50%,^{4,12-14} and the reported foetal mortality between 40 and 80%.¹⁴ In a series of 56 cases reported by Louw⁶ the foetal mortality was 30%, and Rudolph and Fields¹⁵ recorded a maternal mortality of 3.5%, while Rucker¹⁶ lost only 1 mother in 270 so affected.

From these figures it would appear that, although the maternal mortality has diminished in the past 20 years, there has not been the expected improvement in the outlook for the infant that should have been associated with the rising standard of antenatal and intranatal care.

TREATMENT

A. When Diagnosed in the First Stage of Labour

Intelligent expectancy should guide the attendant here, and all efforts should be directed against allowing the mother to become exhausted and despondent:

(a) Adequate sedation in the form of morphine, gr. $\frac{1}{4}$, or pethidine, 100 mg., should be given.

(b) Fluids by intravenous infusion must be given where indicated, and therefore a strict watch must be kept for commencing dehydration and acidosis.

(c) An antibiotic cover should be started early as a prophylactic measure.

The condition is rarely diagnosed in the first stage of labour as emphasized by White.¹²

B. When Diagnosed in the Second Stage of Labour

Greenhill¹⁷ states: 'When constriction ring dystocia persists during the second stage of labour, this stage may last for 24 hours or more, and the uterus will not rupture spontaneously, regardless of the duration of labour, if the cephalopelvic relation and the position and presentation are normal'. This is a point of view on which many would not agree, holding that once the cervix is fully dilated steps should be taken to effect immediate delivery of the infant. There is no doubt that the longer the second stage is allowed to continue, the higher will be the foetal mortality and morbidity.

Conservative measures should always be tried initially. These include:

1. Amyl nitrite inhalations, which will have the desired effect on some occasions.

2. Adrenaline, 8 minims, by slow subcutaneous injection may be of value. However, Kaiser and Harris¹⁸ emphasize that this substance in high concentrations is oxytocic through-

out the uterus and has very marked systemic effects. In low concentrations it is said to be inhibitory to uterine activity and probably has no systemic effects. It has the added advantage of not being a respiratory depressant for the child.

3. Deep general anaesthesia, preferably with chloroform or ether, which are sympathomimetic drugs, should be tried and may have the desired effect. Cyclopropane, a parasympathomimetic drug, should never be used.

4. Magnesium sulphate, 2 ml. of a 50% solution, or magnesium gluconate, 10 ml. of a 20% solution, are recommended by Abarbanel.¹⁹ The magnesium is said to act directly on the myometrium in slowing the rate of the contraction wave. Calcium chloride should always be on hand in case of collapse of the patient.

5. Caudal anaesthesia has been used, but its effects are completely unpredictable and variable. The muscle relaxants have no effect whatever on a constriction ring.

Generally speaking the constriction rings which will respond to conservative measures are of the reversible type, and will do so within a relatively short period of time. These measures should not be continued with indefinitely in the hope of avoiding a Caesarean section, for prolonged efforts invariably endanger the life of the infant. It is far better to deliver a live baby by Caesarean section, than a dead or dying baby by the vaginal route.

Should the conservative measures be successful and result in relaxation of the ring, spontaneous delivery, forceps delivery, or breech extraction can easily be performed—depending on the circumstances pertaining at the time.

Vaginal delivery should not be undertaken until the ring has relaxed. Forceps delivery, version with or without extraction, craniotomy, embryotomy, and Dürrsens incisions are not only contra-indicated, but are extremely hazardous.

The Role of Caesarean Section in this Condition

If the ring cannot be overcome by an adequate trial of the above measures, and with the infant still alive, Caesarean section should immediately be performed. The present-day safety of the operation, with antibiotics, blood transfusion, and improved anaesthetic techniques, makes it the procedure of choice under these circumstances and where there is any added complication, e.g. pre-eclampsia, questionable disproportion, or infertility in an elderly primigravida.

With a dead infant, heavy sedation, general resuscitative measures, an antibiotic cover, and patience will frequently result in relaxation of the ring and vaginal delivery. Consideration of the foetus does not arise here, and time is on the side of the attendant. It is as well to remember that Caesarean section may even be necessary under these circumstances in the interests of the mother, and that this condition is one of the rare remaining indications for a classical Caesarean section, where the foetus is tightly gripped by a constriction ring in the upper segment.

Constriction Rings in the Third Stage of Labour

The separation of the placenta and its delivery are de-

pendent on contraction and retraction of the upper uterine segment. As the trunk of the foetus leaves the uterus, retraction occurs, and it is believed that the placenta is separated from its bed within 1-5 minutes.²⁰ It does, however, take 10-15 minutes before it descends to the lower uterine segment, possibly due to adherence of the membranes. The signs formerly associated with 'placental separation' should perhaps be more rightly termed 'signs of placental descent'.

Any upset in the normal action of the uterus will lead to incomplete separation of the placenta, or retention of the separated placenta with the attendant dangers, chiefly postpartum haemorrhage. Although one cannot recognize the various individual forms of inefficient uterine action at this stage, constriction ring falls into this category, and an 'hour-glass contraction', as it is often called, will interfere with the expulsion of the placenta.

Probably the main cause of this group of conditions is interference with the fundus of the uterus and premature attempts to express the placenta. The early administration of oxytocics has been incriminated, but this contention has never been proved.

The treatment of a constriction ring at this stage does not as a rule present any difficulty. Manual removal of the placenta, with manual dilatation of the ring where necessary is always successful, although amyl nitrite and deep anaesthesia may be necessary at times.

SUMMARY

1. The types of constriction ring encountered in labour are described and defined.
2. Their aetiology is briefly discussed.
3. Their symptoms, signs, prognosis, and treatment are reviewed.
4. A few illustrative case histories are briefly described.
5. A plea is made for early diagnosis and prompt treatment.

The treatment should be active and radical where necessary, and it is contended that only in this way will the present very high mortality rates, both maternal and foetal, be reduced.

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