THE 'INCOMPETENT CERVIX' AND HABITUAL ABORTION

J. ADNO, M.B., B.CH., DIP. O. & G. (RAND),
Obstetrician and Gynaecologist, Johannesburg

Repeated or habitual abortion has always been a most distressing problem to the obstetrician and gynaecologist, not to say the least for the patient.

Abortion in itself is a fairly common sequel to conception. The incidence quoted in the literature varies from 5·5 to 20%.[1-3] The incidence of spontaneous abortion, however, is difficult to assess as nowadays abortion is so common. Davis[2] states that 90% of all abortions under his care are the result of interference. It was my impression, too, that in hospital practice in Johannesburg, criminial abortion is also within the range of 80-90% of all abortions admitted.

Unfortunately the surveys of abortions do not tabulate the duration of pregnancy at termination. It seems to be the impression of most writers that abortion in the middle trimester is not common at all. According to Baden and Baden[4] 1 in 300 multiparae abort in the middle trimester. Barter *et al.*[5] found 19 cases in 35 months during which time 35,000 patients were delivered of viable infants. My own impression is that middle-trimester abortions occur more frequently than is supposed.

The Aetiology of Abortion

The aetiology of abortion is very varied. During the past 10 years the 'incompetent os', or, 'insufficient' internal os has been incriminated more and more as an aetiological factor for abortions occurring in the middle trimester of pregnancy.

This condition was actually recognized and treated at

about the same time in 3 different countries: in the USA Lash and Lash,[6] in France, Palmer[7] and in India by Shirodkar.[8] The first 2 workers limited their operation to the non-pregnant state, but Shirodkar treated his cases surgically during gestation when the cervix was considerably effaced and partially dilated with bulging membranes.

The causes of this incompetency are numerous and may tentatively be classified as: (1) *Congenital* or hypo-plastic, (2) *physiological*, (3) *anatomical*, where the normal anatomy may be interfered with and the internal-os regions distorted by low-lying myomata or other tumours, e.g. cervical carcinoma, and (4) *Traumatic*, following on over-zealous dilatation of the cervix; childbirth and cervical lacerations, including forceps delivery; amputation of the cervix;[9, 10] low Caesarian sections involving the cervix; induced abortions and Durrhsen's incisions.

Lash and Lash[6] described the anterior defect only but still proceeded with surgical repair if this was not demonstrated, but where the diagnosis of incompetency was made.

Shirodkar,[11] however, realized that the defect might be in the entire circumference of the cervix or in an area other than the anterior portion. He thus devised a 'purse-string' repair about the internal os.

Since the original communications on this subject various authors have added to the number of cases diagnosed and treated. In 1955 Lash,[12] had operated on 44 patients of which 29 conceived and 27 had full-term infants. Of the 27, 2 had repeated repairs and 2 cases required 3 repairs before they achieved a positive result. Shirodkar[11](*a*) operated on 43 cases during pregnancy with a success rate of 79·4% and on 56 non-pregnant women with a success rate of 85·5%.

Green-Armytage and McClure Browne[13] describe their technique and report 12 operations. Eight were done during pregnancy with successful delivery of 3. One conceived soon after the operation and subsequently had a live child. Three had not yet conceived and 5 cases operated upon during the 15th and 20th week of gestation were still pregnant at the time of publication.

Baden and Baden[4] describe one case at 25 weeks duration of pregnancy where the cervix was 2-3 cm. dilated with the membranes bulging into the vagina. Trachelorrhaphy was done by excising tissue wedges on either side of the cervix and resuturing the raw edges. This case was subsequently delivered normally at 35 weeks.

McDonald[14] reports 70 cases on which ligation of the cervix was performed for inevitable miscarriage. All the cases presented with dilatation of the cervix and bulging forewaters during the second trimester. All, with one exception, had had one or more miscarriages. Of the 70 patients 33 gave birth to infants who survived. Sixteen others had their pregnancies extended by periods exceeding 4 weeks, but the offspring did not survive.

Johnstone[15] reports one successful case of trachelorrhaphy followed by pregnancy which was terminated at 38 weeks by Caesarian section. He also reports a second case where a tantalum wire was passed around the upper cervix and tied in a loop about it. Following this, the patient conceived and was still in a state of pregnancy at the time of writing.

DIAGNOSIS

Careful evaluation of the history in a patient with repeated middle-trimester abortions is the best indicator that incompetence of the cervix may be present. Sudden loss of the amniotic fluid between the 16th and 18th weeks of pregnancy, not preceeded by painful contractions or haemorrhage, is an important feature in the history. This is usually followed by a rapid and relatively painless extrusion of the products of conception. Lash, however, says that the same pregnancy history may be obtained in anomalies of the uterus, in submucous fibroids as well as in the congenital condition (hypoplasia) described by Palmer and the physiological disturbances described by Asjund in Stockholm.

Barter *et al.*[5] write; 'If the patient has a history of middle-trimester abortions, the most convincing means of proving that the cervix is incompetent is to examine the patient at weekly intervals during the gestation. If incompetency of the cervix is present, the cervix becomes effaced and dilated between the 14th and 26th week of gestation. The process may take place slowly over several weeks. On the other hand, it may take place more rapidly and within the interval of a week will have become completely effaced and 5-6 cm. dilated. In a completely typical illustration of this condition the foetal membranes are under no apparent tension and the uterus is not irritable. The cervical dilatation appears to be a passive process.'

Baden and Baden[4] suggest that when incompetency of the cervix is suspected, weekly vaginal examinations should be done.

Any cervix found to be 1·5 cm. or more dilated, before the 28th week of gestation, should be considered incompetent and trachelorrhaphy considered. In the non-pregnant state determination of the diameter of the cervical canal, at the level of the internal os, can be performed in various ways. The diameter can be measured by using Hegar dilators and assessing which size approximates the diameter of the canal with least resistance. Measurements of 4 mm. to 8 mm. have been incriminated as proving incompetence of the internal cervical os.

Radiological procedures have also been described. The introduction into the uterus of a balloon, connected to a cannula, has been described by Rubowitz and Cooperman.[16] The authors suggest that the syndrome is not present if difficulty is encountered in introducing the balloon through the cervix. Three to 4 c.c. of radio-apaque fluid is injected into the balloon and a plate is taken. This gives a good outline of the cervico-uterine angle and the area of the internal os. Small amounts of fluid are then removed and with traction on the cannula, serial X-rays are taken to demonstrate the contour of the entire cervical canal.

The lipiodol technique, described by the same authors, consists of injecting 4-5 cm. of lipiodol into the uterine cavity through a Rubin cannula. An X-ray plate is taken. The next plate is taken simultaneously with the withdrawal of the cannula, leaving the tentaculum forceps in place to designate the position of the external os. They claim that with a defective os there is spilling around the cannula, whereas with a normal os the cannula plugs the canal and does not allow a backflow of the dye. Obviously, there will be spillage of the dye if the cannula is withdrawn too far.

I think that the most important point in the radiological diagnosis is to be able to demonstrate an abnormally wide canal. This can only be done by allowing backflow of the dye to occur. In the present series of cases the simple technique of hysterosalpingography was employed, using either the

Frazer or Jarcho type of cannula. The Jarcho instrument is most probably more suitable since it does not dilate the cervix as much as the Frazer cannula does. The actual width of the canal may be measured by using the measurement of the cannula and correcting accordingly.

The most interesting and stimulating work, to my mind, performed on the diagnosis of this condition, is that of Hurter *et al.*[17] They used the enzyme papain, which is the crude, dried powdered latex from the green fruit of the papaya tree (*Carica papaya*), and state that they have found a form of incompetence, other than structural or congenital, which is not demonstrable by the usual means and is apparently of different origin.

By their technique of injecting the papain enzyme into the vagina, it soon became apparent that some action other than the simple removal of mucus was taking place. The cervical and uterine shadow was so markedly changed that they were convinced that some relaxing effect was being obtained. The cervical canal in particular was grossly dilated. Relaxation of the cervix was so marked in some of the cases that a probable beneficial effect on dysmenorrhoea was suspected and actually successfully demonstrated.

All the patients revealing this relaxation of the internal os with papain had lost 3 or more pregnancies between 12 and 20 weeks. Once having aborted, none of them have subsequently carried a pregnancy to term without cervical repair. Three of the cases who aborted were brought to curettage, and it was noted that the cervix was different to the average and to the socalled 'incompetent os' cervix. The cervix was widely dilated, soft and appeared as a cuff of tissue about 1 cm. in thickness. This measurement was uniform throughout the cervical circumference and extended into the uterine cavity. There was no ridge at the internal os as usual. The curette could be passed from the fundus of the uterus to the internal os without a trace of tissue obstruction. The internal os had completely disappeared.

Three of the patients demonstrating these changes have been operated upon, using the Lash method. Two have subsequently become pregnant only to repeat the original chain of events. While the repair by this method has served very well for those who demonstrate a structurally incompetent os, it is not sufficient re-enforcement for the type described. Hurter *et al.*[17] have developed a different type of repair, which they do not illustrate, and they are awaiting results.

In no case, without this history of pregnancy loss beyond 12 weeks, has such a change been shown using the enzyme. The enzyme-induced dilatation is apparently a specific means of demonstrating the physiologically incompetent os.

TREATMENT

The correction of the defect can be performed by various surgical procedures. Lash and Lash[6] describe the anterior repair where a wedge of cervix is removed and the exposed surfaces resutured, or the defect is oversewn. They perform this operation whether there is an anterior defect or not, provided that they are sure of the diagnosis.

Various techniques in placing a 'purse-string' suture about the cervix at the level of the internal os, have been described. Shirodkar and Barter used a fascial strip from the thigh. Reactive cellophane[18] containing dicetyl phosphate was wrapped around the cervix below the mucosa. Page[18] cautions against the use of non-absorbable material which may not yield to the forces of premature labour. He quotes one case where the uterus ruptured during a premature labour.

Various tissue irritants have been used to stimulate fibrosis. Deep cervical cautery has also been used with this object in view. The use of talc has been mentioned but this has not improved the results and produces the danger of a talc granuloma at a later date.

Dacron is regarded as very suitable as it stimulates fibrous-tissue growth through its mesh. Stimulation of fibrous-tissue growth by either silk or polyethylene is of a minimal degree. Dacron is a more permanent suture for further pregnancies, but the danger of a permanent structure has already been mentioned. McDonald used a No. 2 chromic catgut in one case and this procedure was repeated during the same pregnancy when the cervix again showed signs of dilating. No. 4 Mersilk was used in the remainder of his cases. Green-Armytage used a 7N or 8N nylon suture. Shirodkar at present prefers to use $\frac{1}{8}$ inch (3 mm.) nylon tape. Johnstone describes the use of a tantalum wire.

In case 1 of the present series, a doubled No. 4 nylon suture and in addition a No. 22 kangaroo tendon was used.

Lash and Lash[6] had at least 2 cases in which more than 1 infant has been delivered through the birth canal following the operative procedure. They implied that, once the correction had been accomplished, subsequent childbearing did not destroy the effectiveness of the successful repair. They also claim that fertility is not affected by surgical repair. Some authors suggest that the best results have occurred when the operation is done after the 12th week of pregnancy.

CASE REPORTS

Case 1

D.C., aged 34, had aborted on 5 occasions:

(1) In 1947 at 17-18 weeks. Membranes ruptured while asleep.

(2) In 1948 at 20 weeks. Started bleeding accompanied by pain.

(3) In 1950 at 24 weeks. Had a 'show' at 4-5 weeks before the abortion.

(4) In 1952 at 26 weeks. Infant survived a few hours.

(5) In 1956 at 28 weeks. Infant survived for 12 days. All the labours were extremely quick.

She had not responded to any of the known treatments for habitual abortion.

The patient was first seen in August 1957, when she was approximately 9 weeks pregnant. General examination showed no abnormality. Rh positive, Group B. Hb. 15 g.%. In view of her history a tentative diagnosis of incompetent cervical os was made and it was decided to observe the state of the cervix at weekly intervals.

On reconsideration of the case at 20 weeks duration of the pregnancy, one decided to proceed with the Shirodkar type of operation. This was decided upon, because of the rather sudden onset of the previous labours.

On 20 October 1957, under pentothal, nitrous oxide and ether anaesthesia, the operation was successfully performed using a doubled No. 4 nylon and a No. 22 kangaroo-tendon sutures. Four hours later uterine contractions commenced, but were soon interrupted with heavy omnopon sedation and the use of a full course of relaxin (releasin).

At about 5 p.m. on 21 February 1958 labour commenced and the patient was admitted to hospital. Speculum examination showed that the nylon suture had cut through the cervix anteriorly and laterally on the left side. The suture now occupied a position immediately beneath the endocervical mucosa. This stitch was cut and removed after which the cervix immediately dilated to 3F. The kangaroo-tendon suture was not to be found at all. During the procedure the membranes ruptured. Contractions proceeded very intermittently, requiring 3 doses of pitocin 2 min. At 4.10 a.m. on 22 February 1958 a healthy male

child weighing 6 lb. 12 oz. was delivered. An episiotomy was done.

Two months after the delivery the cervix still showed the antero-lateral defect. It also still displayed the stricture effect of the suture—possibly fibrosis due to the kangaroo tendon. Radiography of the cervical canal did not reveal any gross dilatation. Although, at a previous diagnostic curettage, another practitioner found that the canal, in the non-pregnant state, accommodated a 10 Hegar dilator with ease.

Case 2

D.A., aged 32. She had 2 previous abortions:
(1) In 1955 at 12 weeks. No D and C.
(2) In 1956 at 4½ months. Manual removal of placenta.

She was first seen at 8 weeks of the third pregnancy. A progesterone implant was done and the pregnancy progressed favourably until the 20th week, when spontaneous rupture of the membranes occurred. The patient was confined to bed and sedated, but 3 weeks later labour commenced. Within an hour of receiving the first injection of relaxin (releasin) contractions ceased. Twelve hours later, however, the breech of the foetus appeared at the vulva and the patient aborted. The labour was painless. A manual removal of the placenta had to be performed and at operation a defect of the cervix at 8 o'clock was suspected. It was thus decided to do a Shirodkar operation at a later date. This was successfully done in December 1957.

After the operation we managed to obtain previous hysterosalpingography pictures, and these absolutely confirmed the diagnosis of incompetent cervix with a wide canal (Fig. 1). This patient has not as yet conceived.

Fig. 1. An incompetent cervix with a wide canal.
Fig. 2. The normal width of the cervical canal.

Case 3

D.A., aged 33, had had 3 previous abortions:
(1) In 1955 at 2 months. No D and C.
(2) In 1956 at 5½ months. Commenced with a 'show' followed by a very quick labour and an aborted infant. (800 g.) which survived 4 hours.
(3) In 1957 at 5½ months. Extremely short labour.

On general examination no abnormality was detected. On gynaecological examination no abnormality was revealed, except for the fact that a 6 mm. Hegar dilator could be passed into the uterus without any difficulty. The diagnosis of incompetent cervix was made and the wide canal was confirmed radiologically.

A Shirodkar type of operation was performed. Three months later the patient developed a vaginal discharge and on examination sepsis was found present so that the suture was removed. The operation might be repeated at a later date, but there is hope that the sepsis might have produced a fibrous repair.

Case 4

T.S., aged 33, with the following history:
(1) In 1951 a full-term male infant, 6¼ lb.
(2) In 1952 a full-term female infant, 6 lb.
(3) In 1955 she aborted at 6 months; in labour 4 hours.
(4) In 1957 she aborted at 4½ months; D and C performed.

No abnormalities were detected on general examination, but on gynaecological examination a 8 mm.-Hegar dilator could be passed into the uterus without any difficulty. The wide canal was confirmed radiographically. No surgery as yet.

Case 5

V.T., aged 38, with the following history:
First marriage.
(1) In 1944 premature labour at 32 weeks; female weighing 3 lb. survived.
(2) In 1946 premature labour at 30-32 weeks. An infant weighing 2 lb. 4 oz. survived for 2 days.
(3) In 1947 she aborted at 28 weeks.
(4) In 1948 she aborted at 3 months; D and C performed.
Second marriage.
(5) In 1955 she aborted at 2 months; D and C performed.
(6) In 1956 she aborted at 6 months; spontaneous rupture of the membranes; quick labour.

On examination no abnormality was found, except that the internal os was the diameter of a 8 mm.-Hegar dilator. The wide canal was demonstrated radiologically. No surgery as yet.

DISCUSSION

On the basis of the clinical, radiographical and surgical experience with patients of the type reported, it appears that the ability of the uterus to contain and carry a pregnancy is a function, in part, of the competence of the area of the internal os, including the cervico-uterine angle, the anatomic internal os and the cervical structure immediately subjacent. Conversely, distortion and weakening of this region of the internal os, whether from anomalies or trauma, will interfere with the continuation of the pregnancy. If the anomaly or injury is of a high order, abortion in the second trimester may result. It is tempting to speculate on the possibility that distortion of a lesser degree may be aetiological in some cases of premature labour.

The question still arises as to where the actual defect in function occurs. Is it the entire uterus and cervix at fault, or is the internal os alone defective? What has happened to the factors which normally limit the taking up and dilating of the cervix until the pregnancy reaches a mature state?

At no stage yet has any worker proved a definite circular muscular sphincter at the internal os; fibrous and muscular content of the cervix has however been demonstrated.[19]

The isthmus of the uterus, first described by Aschoff of Freiburg,[20] is that part of the cervix which lies between the anatomical os above and the histological internal os below. Its' average length is 4·5 mm.[21] It differs from the corpus, in that the glands are tubular and do not respond well to the action of the sex hormones. These glands do not shed to any great degree during menstruation and according to Frank[22] the glands contain little or no glycogen. They differ from the cervical glands in that they contain no mucous. Browne[23] says that there is little or no decidua formation in pregnancy.

Stieve[21] has shown that the isthmus is expanded and opened at the end of the second month of gestation to become part of the corpus. When the isthmus is completely taken up, the histological internal os becomes the internal os proper of the uterus and is alleged to remain so until term.

McDonald,[14] in his paper, comments on the 2 categories of cases with protruding forewaters. In one the forewaters are under tension, while in the other there is little tension. The best operative results were obtained in the cases where the intra-uterine pressure was low. This tends to suggest that the dilatation of the cervical os is certainly related to the

tone or irritability of the entire uterus. If the uterus is contracting and the observation of the bag of forewaters happen to be made at the same time, then obviously the forewaters will be bulging and *vice versa*. If the forewaters rupture, then the patient will commence labour. The stage at which the membranes will rupture, will depend upon the dilatation of the cervix as well as on the strength of the foetal membranes. Pascal's law[15] has been used in attempting to explain the reason for the membranes rupturing. That is all very well, but why does the cervix dilate creating the circumstances favourable for the membranes to rupture? This question can only be answered when we can explain the mechanism of labour.

The 'purse-string' suture certainly prevents dilatation of the cervix and seems to take the place of some missing or defective structure.

In conclusion I would like to say that the mechanism of the dilatation of the cervical os is still a mystery, much as is the mechanism of normal labour. I must emphasize that the procedures described in the present paper are not a cure for abortion. The operation should not be used indiscriminately but only in those cases where the condition has been proved, or is very strongly suspected.

ADDENDUM

Since this article was submitted for publication cases 2 and 3 have conceived. Case 3 at 19 weeks required a repeat operation because the internal os admitted one finger with ease; the pregnancy is continuing.

SUMMARY

1. The problem of abortion in the second trimester, relative to an incompetent cervical os, is discussed.

2. The literature is reviewed with reference to the diagnosis and treatment.

3. Five cases are reported; 3 have been operated upon, and 1 living child has already been born.

4. The operative procedures discussed are not the cure for abortion, but should only be used in proved or strongly suspected cases.

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