ULTRASONIC ASSESSMENT OF CERVIX IN 'NORMAL' PATIENTS

by

(Mrs.) T. R. Varma

R. H. Patel

and

(Miss) Usha Pillai

SUMMARY

We studied 30 normal pregnant women from the first trimester to 36 weeks. This group of patients had no previous miscarriage, termination of pregnancy, operations on the cervix or premature labour. Fifteen were primigravidae and the remaining were multigravidae. There was no significant difference in the length of the cervix from 10 to 36 weeks of gestation ($P > 0.05$). The mean width of the cervix gradually increased from 10 to 36 weeks of gestation ($P > 0.01$). The mean width of the cervical canal showed no significant change from 10 to 36 weeks of gestation ($P > 0.05$).

Introduction

Incompetence of the sphincter mechanism of the uterus is now a well-established cause of habitual miscarriage in the middle trimester. Cervical incompetence was first described by Palmer and LaComme (1948). Since 1957 much literature has accumulated and many series have been recorded, notably Barter *et al* (1958), Taylor and Hansen (1959) Lash (1961) and Brandy and Peterson (1961).

The incidence of cervical incompetence to all pregnancies varies from 0.05 per cent to 1 per cent (Barter *et al* 1958; Jennings, 1972; Kuhn and Pepperell, 1977). However, as many as 16 per cent of second trimester pregnancy losses are due to cervical incompetence (Stromme and Haywa, 1963). Classically, cervical incompetence has been characterised as a repetitive, acute, painless second-trimester abortion without associated bleeding or uterine contraction. It is often associated with premature rupture of membranes or bulging of the fetal membranes into the vagina. Prematurity is one of the main problems in obstetrics and in perinatal period. The incidence has not changed much in spite of trials of different treatment modalities. One reason for premature birth is cervical incompetence.

Several diagnostic procedures have been suggested for the non-pregnant woman whose history is suspicious but not diagnostic of cervical incompetence. Passage without resistance of a Pratt dilator, Goodell dilator or a Hegar No. 8 dilator into the cervical canal is suggestive of cervical incompetence (Craig, 1973; Jennings, 1972; Toaff and Toaff, 1974). Although this procedure is consistent with other direct methods of

From: Ultrasonic Department, (Obstetrics and Gynaecology), St. George's Hospital Medical School, Cranmer Terrace, London, S.W. 17.

Accepted for publication on 14-1-84.

measurement of the cervical canal diameter (Holman, 1973; Johnstone *et al*, 1976) neither these, nor radiographic measurement (Asplund, 1952; Peterson and Keifer, 1973) or traction tests (Bergman and Svennerund, 1957) are invariably diagnostic of cervical incompetence. Usually, the diagnosis of this condition was made retrospectively and based on past obstetric history of repeated second-trimester abortions and/or early premature labour resulting from painless gradual effacement and dilatation of the cervix and sudden unexpected spontaneous rupture of the amniotic sac. The proper choice of the operative method and the selection of the optimum time, whether during pregnancy or in the non-pregnant state, can be improved by a thorough diagnostic study of cervical incompetence. Ultrasonography can provide an additional method for the diagnosis of cervical incompetence. This is non-invasive and is safe during pregnancy. This method was found to be promising by Vaalamo and Kivikoshki (1978); Sarti *et al* (1979); Brook *et al* (1981) and Vaalamo and Kiviskoski (1983).

We decided to study 30 normal patients who had no previous miscarriage, terminations of pregnancy, operations on the cervix or premature labour, of which 15 were primigravidae and the remaining 15 were multigravidae. This study was planned to assess the changes in the cervix of pregnant women from the first trimester until 36 weeks of gestation.

Material and Methods

All ultrasonic examinations were performed using Gray scale of Diasonograph 4200 (Nuclear Enterprises Ltd). Bimanual examination was made to determine the position and direction of the cervix. The balloon of Foley catheter was inserted against the external cervical os and the balloon (30 ml) was filled with water to identify the external cervical os initially. The full bladder technique was used. Patients were requested to empty the bladder and drink 500 mls of water one hour before the ultrasonic examination was performed. A bladder filled to a volume of 400-500 ml will clearly demonstrate the vagina, cervix and the region of the internal os.

Longitudinal scans were done following the direction of the cervix at 5 mm intervals. When the cervical canal was visualised, the scans were adjusted to see the whole length of the cervical canal. The lateral walls of the cervix will show echoes similar to those of the rest of the uterine myometrium. The endocervical canal will appear as a strong linear echo usually in the centre of the myometrial echoes of the cervix (Fig. 1). If the bladder is not properly filled the cervix will be shorter and bulkier in appearance. A short contracted cervix often appears more lucent due to inadequate filling. The endocervical canal will be difficult if not impossible to visualise under this circumstance. As the bladder fills, the cervix will stretch and elongate giving better visualisation of the endocervical canal. If the bladder is distended it can markedly elongate the cervix (Fig. 2). Overfilling will increase bladder pressure and may also increase pressure on the lower uterine segment and the cervix appears to be closed, whereas under less pressure it might appear open. In cases in which there is a high index of suspicion of a dilated endocervical canal we first study the urinary bladder completely filled and then again following partial emptying (Fig. 3).

We studied 15 primigravidae and 15 multigravidae. The age of the patient

ranged between 18 and 40 and the parity ranged between 0 to 5. The length of the cervix, the whole width of the cervix at the level of internal cervical os were measured longitudinally from 10 to 36 weeks of gestation at intervals of 2 weeks. The length of the cervix was measured from the external cervical os which was identified using a Foley's catheter bulb filled with 30 ml of water and the full bladder technique, to the internal cervical os which was identified as the level of the angle between the uterine cervix and body at the point of the greatest anterior posterior diameter. The whole width of the cervix at the internal cervical os level was measured at the point of the greatest anterior posterior diameter (Fig. 4). This measurement included the echoes produced by the cervix which were similar to those of the rest of the uterine myometrium. The width of the cervical canal at the level of the internal cervical canal was measured (Fig. 5). All measurements were done using a digital caliper.

Results

Table I shows the mean cervical length, cervical width and the width of the cervical canal and the 2 standard deviations for each week of pregnancy from 10 to 36 weeks for the 30 patients including primigravidae and the multigravidae.

The mean cervical length ranged between 3.97 to 3.02 cm. There was no significant difference in the length of the cervix from 10 to 36 weeks of gestation ($P > 0.05$). The mean width of the cervix at the level of the internal cervical os, showed a gradual increase from 1.58 cm to 4.02 cm from 10 to 36 weeks gestation. The difference was significant ($P < 0.01$). The mean width of the cervical canal remained more or less the same from 10 to 36 weeks of gestation. It ranged between 4.38 mm and 5.53 mm.

Table II shows the mean and 2 standard deviations of the length of the cervix, the width of the cervix at the level of internal cervical os and the width of the cervical canal from 10 to 36 weeks of gestation in the primigravidae and multigravidae.

When we analysed the mean cervical length for the primigravidae and multigravidae separately we did not find any

TABLE I

Mean and 2 Standard Deviations of the Length of the Cervix, the Width of the Cervix at the Level of Internal Cervical os and the Width of the Cervical Canal from 10 to 36 Weeks Gestation

	Weeks in Gestation													
	10	12	14	16	18	20	22	24	26	28	30	32	34	36
	Length of Cervix in Cm													
Mean	9.02	3.06	3.4	3.76	3.66	3.38	3.76	3.82	3.97	3.48	3.63	3.45	3.08	3.06
SD	0.61	0.62	0.76	0.64	0.61	0.63	0.63	0.61	0.83	0.51	0.55	0.65	0.54	0.26
	Width of the Cervix at the Level of nternal Cervical Os in Cm													
Mean	2.58	3.02	2.84	3.16	3.27	3.52	3.44	3.20	3.44	3.56	3.67	3.88	3.86	4.02
SD	0.41	0.48	0.44	0.56	0.56	0.67	0.63	0.78	0.71	0.68	0.44	0.58	0.45	0.42
	Width of the Cervical Canal in Mm													
Mean	4.67	4.92	4.83	4.77	4.67	5.10	4.94	4.92	4.50	5.53	4.68	5.22	4.38	4.77
SD	0.86	0.84	1.08	1.18	0.84	1.04	0.60	0.92	0.64	1.03	0.83	1.15	0.81	0.86

TABLE II

Mean and 2 Standard Deviation of the Length of the Cervix, the Width of the Cervix at the Level of Internal Cervical Os and the Width of the Cervical Canal from 10 to 36 Weeks of Gestation in the Primigravidae and Multigravidae

	Weeks in Gestation													
	10	12	14	16	18	20	22	24	26	28	30	32	34	36
	Mean Length of Cervix in Cm													
Primigravidae														
Mean	3.02	2.95	3.67	3.64	3.28	3.31	3.33	4.07	3.62	3.53	3.45	3.36	3.28	3.23
SD	0.42	0.32	0.34	0.41	0.32	0.28	0.36	0.41	0.38	0.40	0.32	0.28	0.31	0.29
Multigravidae														
Mean	2.94	3.10	3.75	3.71	3.85	3.41	3.60	4.08	3.58	3.75	3.52	3.62	3.45	3.20
SD	0.29	0.40	0.32	0.34	0.33	0.32	0.36	0.31	0.29	0.28	0.31	0.32	0.31	0.31
	Mean Width of the Cervix at the Level of Internal Cervical Os in Cm													
Primigravidae														
Mean	2.64	2.98	3.0	3.28	3.19	3.40	3.37	3.53	3.64	3.73	3.83	3.72	3.68	3.78
SD	0.30	0.31	0.32	0.28	0.26	0.31	0.38	0.34	0.38	0.33	0.35	0.32	0.36	0.37
Multigravidae														
Mean	2.86	3.20	3.40	3.48	3.63	3.66	3.78	3.85	3.91	3.92	3.96	4.02	4.06	4.08
SD	0.29	0.32	0.34	0.34	0.32	0.34	0.32	0.31	0.29	0.36	0.35	0.33	0.38	0.41
	Mean Width of the Cervical Canal in Mm													
Primigravidae														
Mean	4.52	4.66	4.12	4.5	4.6	4.23	4.5	4.9	5.2	4.8	4.7	4.8	4.9	5.3
SD	0.64	0.64	0.65	0.58	0.48	0.52	0.51	0.48	0.5	0.62	0.61	0.58	0.52	0.59
Multigravidae														
Mean	4.62	4.68	4.87	5.20	4.56	5.6	5.2	5.3	4.9	5.2	5.05	5.2	5.3	5.1
SD	0.49	0.51	0.48	0.51	0.52	0.54	0.52	0.51	0.48	0.61	0.48	0.49	0.55	0.58

significant difference in the length of the cervix ($P > 0.05$). When we looked at the mean cervical width for the primigravidae there was a slight difference between the two means from 10 to 36 weeks of gestation though not highly significant. The mean width of the cervix for the primigravidae was 2 to 3 mm less than the mean width of the cervix for the multigravidae at all periods of gestation. There was slight differences between the mean width of the internal cervical os for the primigravidae and multigravidae. The mean width of the cervical canal for the primigravidae was slightly less than the mean width of the cervical canal for the multigravidae at all the gestational periods ($P > 0.05$).

Discussion

In a normal pregnancy, the cervix remains closed to assure adequate fetal maturation. The incidence of incompetent cervix in relation to the number of normal deliveries has been established. There is a wide variation in the literature from 0.1 to 1.8 per cent (McDonald, 1980). This variation arises partly because there

are no standard criteria for the diagnosis of cervical incompetence.

Anatomically, the cervix consists mainly of fibrous tissue and isthmus consists mainly of muscular tissue. The mean population of smooth muscle varies between 6.4 per cent in the lower third of the cervix, 18 per cent in the middle, and 29 per cent in the upper third. From the third month of pregnancy the isthmus which is part of the corpus, elongates, dilates and from the fifth month of pregnancy it presents the lowest part of the uterine cavity (Cousins, 1980). Thus the shortening of the cervix is a physiological phenomenon of the mid-trimester and may be misdiagnosed as cervical incompetence. The normal length of the cervical length during pregnancy is about 3.5 cm (3.06-3.97). None of the patients whose cervical length remained 3 cm in length went into labour before 37 weeks. Vaalamo and Kivikoski (1978; 1983) reported that the pregnancies continued without complications if the cervical length was 2 cm or more. Brook *et al* (1981) measured the width of the internal cervical os in 19 women with normal obstetric histories. The mean width of the internal cervical os in their study of normal women was 1.67 cm. If the width of the internal os was below 1.9 cm the pregnancy continued without problems until term. We found that the length of the cervix, in normal uncomplicated pregnancy which ended in labour at 38 weeks or after, was 3 cm or more. The whole width of the cervix at the level of internal cervical os was 2.5 cm at 10 weeks and 4.02 cm at 36 weeks gestation and the width of the cervical canal was 4.5 to 5.5 mm from 10 to 36 weeks gestation.

Ultrasound is a valuable investigative tool and is a simple and non-invasive technique, with minimal inconvenience to the patient and can be repeated. The results are encouraging and further study on a group of patients who were at risk of having a mid-trimester abortion or premature labour was done to assess the value of ultrsonographic examination in identifying the problem early enough to improve the prognosis.

Acknowledgement

I wish to thank Professor G. V. P. Chamberlain and Mr. A. G. Amias for their help and for allowing me to study their patients.

References

1. Asplund, J.: Acta Radiol (Suppl) **91**: 3, 1952.
2. Barter, R. H., Riva, H. L., Parks, J. and Dusbabek, J. A.: Am. J. Obstet. Gynec. **75**: 511, 1958.
3. Bergman, P. and Svennerund, S.: Int. J. Fertil. **2**: 163, 1957.
4. Brandy, J. R. and Peterson, H. H.: Am. J. Obstet. Gynec. **81**: 1191, 1961.
5. Brook, I., Feingold, M., Schwartz, A. and Zakut, H.: Brit. J. Obstet. Gynaec. **88**: 640, 1981.
6. Cousins, L.: Clin. Obstet. Gynaec. **23**: 2, 1980.
7. Craig, C. J. T.: S. Afr. Med. J. **47**: 2000, 1973.
8. Holman, M. R : Obstet. Gynec. **42**: 468, 1973.
9. Jennings, C. L.: Am. J. Obstet. Gynec. **113**: 1097-1102, 1972.
10. Johnstone, F. D., Beard, R. J., Boyd, I. E. and McCarthy, T. G.: Brit. Med. J. **1**: 68, 1976.
11. Kuhn, R. J. P. and Pepperell, R. J.: Aust. N. Zeal. J. Obstet. Gynaec. **17**: 79, 1977.
12. Lash, A. F.: Am. J. Obstet. Gynec. **81**: 465, 1961.
13. McDonald, I. A.: Clinics in Obstet. Gynaec. **7**: 3, 1980.
14. Palmer, R. and LaComme, M.: Gynec et Obstet. **47**: 905, 1948.

15. Peterson, P. G. and Keifer, W. S.: Am J. Obstet. Gynec. 116: 498, 1973.
16. Sarti, D. A., Sample, W. F., Hobel, C. J. and Staisch, K. J.: Radiol. 130: 417, 1979.
17. Stromme, W. B. and Haywa, E. W.: Am. J. Obstet. Gynec. 85: 223, 1963.
18. Taylor, E. S. and Hansen, R. R.: J. Am. Med. Assoc. 171: 1312, 1959.
19. Toaff, R. and Toaff, M. E.: Obstet. Gynec. 43: 756, 1974.
20. Vaalamo, P. and Kivikoski, A.: XX Nordic Congress of Obstetrics and Gynecology, Bergen, 1978.
21. Vaalamo, P. and Kivikoski, A.: Acta Obstet. Gynec. Scand. 62: 19, 1983.

See Figs. on Art Paper I, II