FETAL ELECTROCARDIOGRAM AT LATE GESTATIONAL STAGES IN HORSES*1

PRELIMINARY STUDY

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Since NÖRR first succeeded in recording fetal electrocardiograms (F-ECG) on the horse in 1921, GLAZIER & NICHOLSON and LARKS et al. studied the same subject. Recently, AMADA & SENDA also carried out an experiment on fetal heart rate and F-ECG pattern in pregnant mares, at 5 months of gestation onward. On the other hand, TOO et al.[7] has previously reported on various change in fetal and maternal ECG as well as their heart rates in the course of parturition in the horse.

This article deals with an electrocardiographical study on 17 Percheron mares of advanced pregnancy.

MATERIALS AND METHODS

The animals subjected to the study were 17 pregnant mares in a Percheron herd of the Shintoku Zootechnical Experimental Station in Hokkaido. Some clinical data and the results of fetal and maternal heart rates are abridged in the table. Recording of F-ECG was performed once at various fetal ages during the period from 272 to 342 days which were calculated from the day of the last copulation.

The ECG techniques applied, were the same as those in the case of cattle[5]; bipolar leads, leads 1-3 and 1-4, in which electrodes were placed on the skin surface of the right flank and 2 points of the lower abdomen (figs. 2 & 3). The fetal and maternal heart rates per minute were actually calculated from the number of fetal and maternal QRS spikes in each serial recording for 10 seconds.

RESULTS AND DISCUSSION

In all cases examined F-ECG could be recorded without exception at the

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TABLE *Clinical data and results of fetal and maternal heart rates*

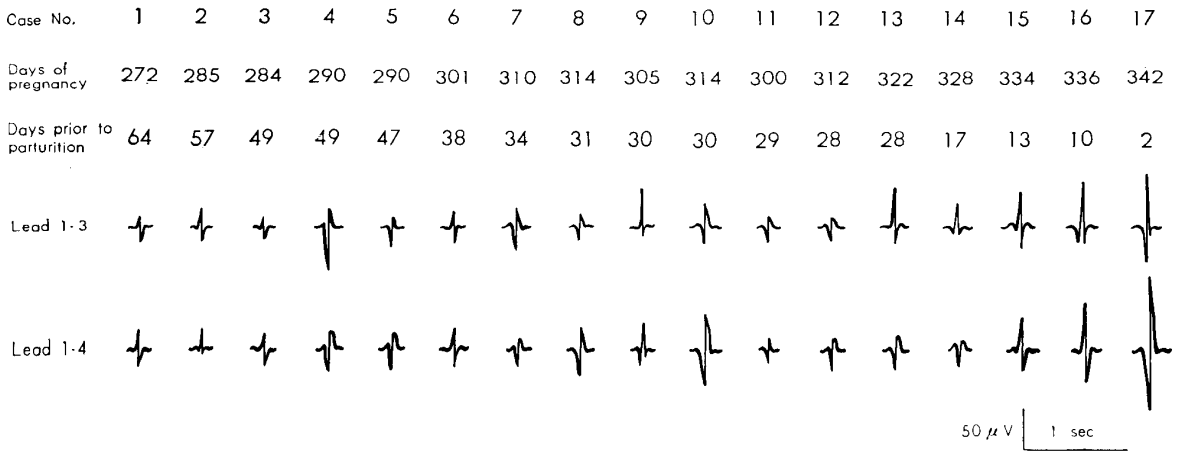
CASE NO.	AGE	NO. OF PARTUS	EXAMINING DAYS		HEART RATE/min		GESTATIONAL PERIOD	SEX OF FOAL	REMARKS
			After copulation	Prior to parturition	Dam	Fetus			
	yr. mo.						days		
1	10.0	5	272	64	42	96	336	♀	
2	4.0	1	285	57	48	114	342	♀	
3	4.0	1	284	49	54	96	333	♀	Stillborn due to dystocia
4	10.2	5	290	49	60	114	339	♂	Died immediately after birth
5	9.0	4	290	47	54	90	337	♀	
6	13.2	6	301	38	48	90	339	♂	
7	5.1	2	310	34	54	90	344	♀	
8	4.2	1	314	31	48	90	345	♀	
9	3.2	0	305	30	78	108	335	♂	Stillborn due to dystocia
10	6.0	2	314	30	48	84	344	♂	
11	7.0	3	300	29	54	84	329	♂	
12	12.1	6	312	28	48	90	340	♂	
13	5.1	2	322	28	48	90	350	♂	
14	5.1	2	328	17	48	84	345	♀	
15	7.2	3	334	13	60	96	347	♂	
16	7.1	3	336	10	72	96	346	♀	
17	7.0	3	342	2	60	90	344	♀	

period from 272 to 342 days of pregnancy. As shown in the table, fetal heart rates varied from 84 to 114, while maternal ones varied from 42 to 78. These variations of both heart rates were comparatively large, and no close relation was observed between them.

According to literature, fetal heart rate in horses has been reported as follows: at 6 months of pregnancy 120 (LARKS et al., in Quarter horse); at 6 months of pregnancy 110~140 per minute and at 11 months 70 (AMADA & SENDA, in race horses); at a period later in gestation 1.7 times of dam's heart rate (GLAZIER & NICHOLSON, in a Thoroughbred); at 20 days prior to parturition 89, and at one day prior to parturition 62 (TOO et al.[7], a half bred horse). The values of fetal heart rate in this experiment seem to be higher than the above workers' results.

In this experiment, the recording of F-ECG was carried out during the last one-fifth of the entire gestational length of the horse. In a study on dairy cattle by the authors[5], the fetal heart rate clearly showed a decreasing tendency during the corresponding period. In this experiment, however, such a tendency of the fetal heart rate with an advance in fetal age was not noticed. In order to ascertain whether the reason is due to the species difference between horses and cattle, much more work will be needed.

FIGURE 1 *Comparison of fetal QRS patterns by two different leads at a period later in gestation*



F-ECG patterns recorded by two different leads in all cases are shown in figure 1. Maternal spikes always showed an R type pattern with a slight variation in amplitude, while fetal spikes varied in pattern and amplitude. In 3 cases (Nos. 15~17) at 13, 10 and 2 days prior to parturition, F-ECG with higher amplitudes were obtained in both leads. In the remaining cases, except No. 10, at 17~64 days prior to parturition, the amplitude was rather low. The initial polarity of

the fetal spike in 3 cases (Nos. 9, 13 & 14) varied with lead position in the same individuals. In 8 cases, the polarity of the fetal spike differed from that of maternal one in lead 1–3, and in 11 cases in lead 1–4. These differences in polarity and amplitude of fetal QRS may be related to fetal position in the uterus against lead positions, as previously discussed by the authors in cattle experiments[6].

As the data presented here were based on only one recording in each case and the observation period was limited to the later stages of pregnancy, it should be emphasized that further fetal electrocardiographical studies on different breeds and at various gestational stages will be required in the future.

SUMMARY

The fetal electrocardiographic technique was employed with 17 Percheron mares at late gestational stages (272～342 days of pregnancy, i.e., 2～64 days before parturition).

In all cases, fetal electrocardiograms could be recorded. The fetal heart rate during the observation period varied from 84 to 114, without any decreasing tendency with progress in fetal development.

The polarity and amplitude of fetal spikes also varied with the different cases.

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EXPLANATION OF PLATE

Fig. 2 General appearance of fetal electrocardiography in a pregnant mare

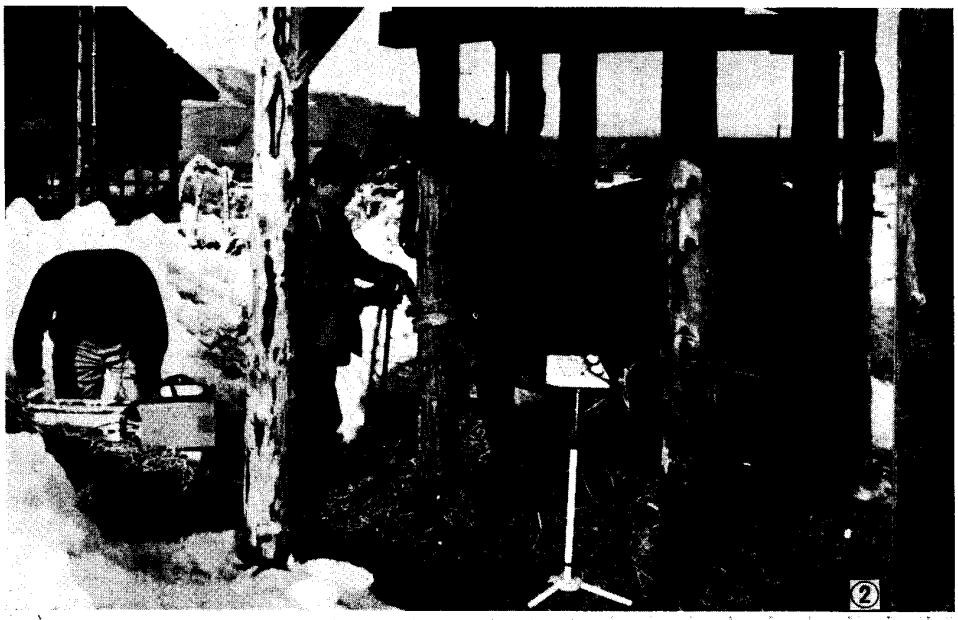
Fig. 3 Application of skin electrodes
1, 3 and 4 indicate lead positions in leads 1-3 and 1-4.

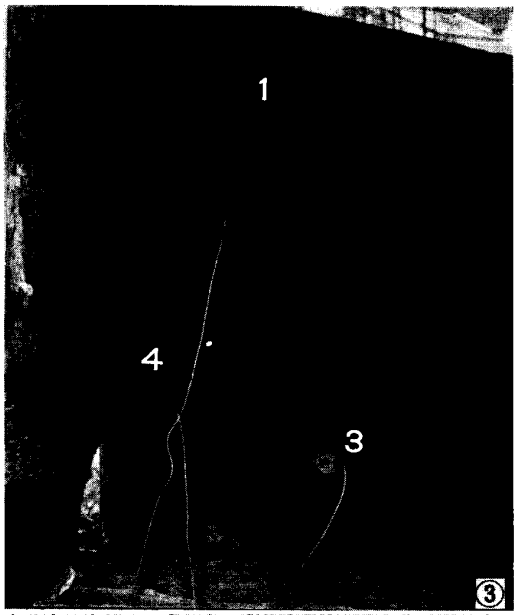
Fig. 4 Fetal electrocardiogram using lead 1-4 at the 300th day of pregnancy, i. e., 29 days prior to parturition (case No. 11)
In figures 4~8, "M" means maternal spikes and "F" fetal ones.

Fig. 5 Fetal electrocardiogram by lead 1-4 at the 322nd day of pregnancy, i. e., 28 days prior to parturition (case No. 13)

Fig. 6 Fetal electrocardiogram using lead 1-3 at the 328th day of pregnancy, i. e., 17 days prior to parturition (case No. 14)

Figs. 7 & 8
Fetal electrocardiograms at the 342nd day of pregnancy, i. e., 2 days prior to parturition (case No. 17)
Figure 7: Lead 1-3
Figure 8: Lead 1-4




1
4
3


M
F
④
⑤
⑥
⑦
⑧
50μV
1 sec