4.1 OVERVIEW OBSERVATION ON FOETAL DEVELOPMENT AND RELATED IMAGES IN REPRODUCTIVE SYSTEM IN DOES USING TRANSRECTAL PROBE (EXPERIMENT 1)

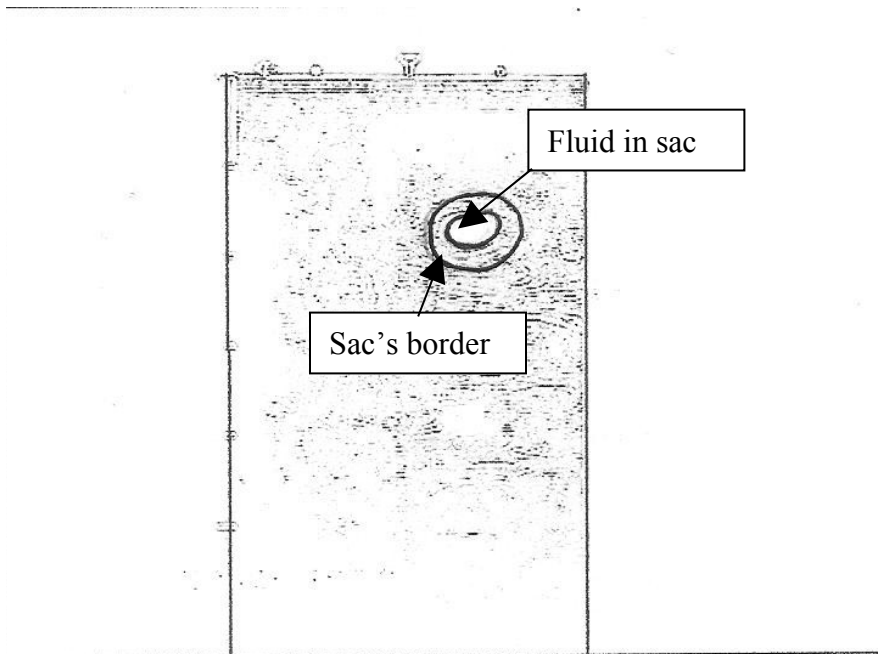
Using 7.5 MHz transrectal probe, the images of different structures indicating pregnancy from days 13 to 142 along gestation period were observed (Table 4.1). Sacs and non-echogenic (NE) areas were observed as early as days 13 to 25 of gestation (Figures 4.1-4.3). Foetus-heartbeat-uterine wall-amniotic fluid was detected as early as 28 days of gestation (Figure 4.4). Placentomes were observed on days 29 of gestation (Figure 4.5). No specific indicators were found using transrectal probe at later stages of pregnancy, i.e. on days 51 to 142 of gestation (Figures 4.6-4.8).

Table 4.1: Images of foetal and related structures during gestation period using 7.5 MHz transrectal probe

Day of pregnancy	Predicted pregnancy	Sac	Non-ehogenic (NE) area*	Placentome	Foetus	Uterine wall	Amniotic fluid	Heartbpeat
13	+	+	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-
23	+	-	+	-	-	-	-	-
25	+	+	-	-	-	-	-	-
28	+	-	-	-	+	+	+	+
29	+	-	-	+	-	-	-	-
51	-	-	-	-	-	-	-	-
66	-	-	-	-	-	-	-	-
70	-	-	-	-	-	-	-	-
85	-	-	-	-	-	-	-	-
111	-	-	-	-	-	-	-	-
118	-	-	-	-	-	-	-	-
121	-	-	-	-	-	-	-	-
133	-	-	-	-	-	-	-	-
142	-	-	-	-	-	-	-	-

+ = predicted positive pregnancy indicator
- = predicted negative pregnancy indicator
* expected structures were allantoic fluid, amniotic fluid

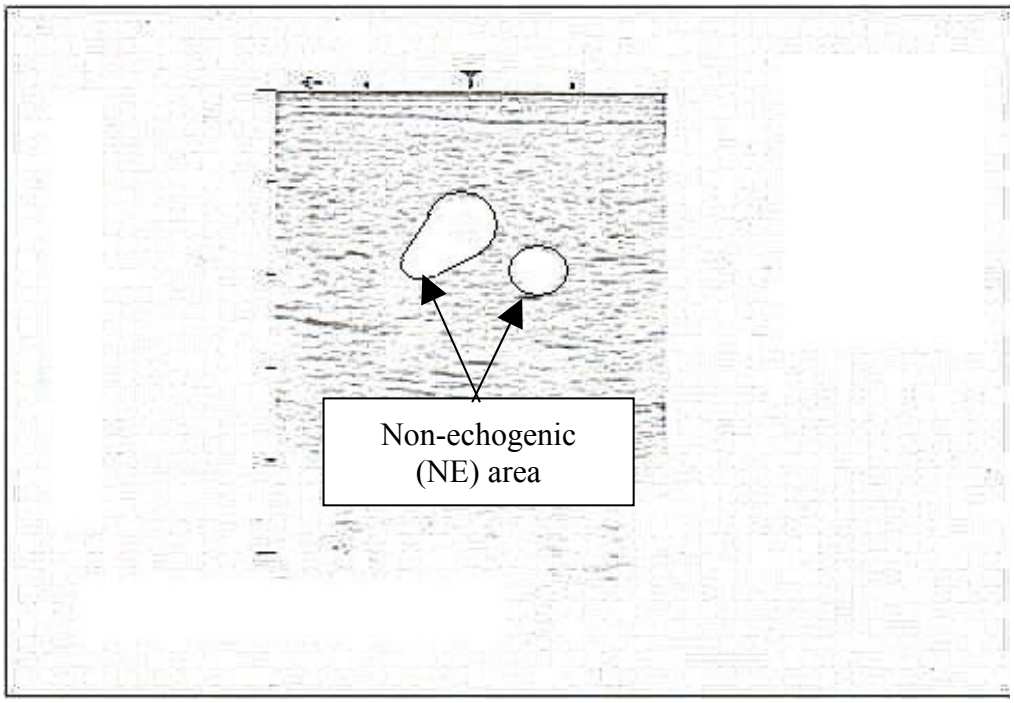
(A)



(B)

Figure 4.1: Image (A) is an original image. Sac was detected on day 13 of gestation (initial stage). Image (B) is a labeled image.

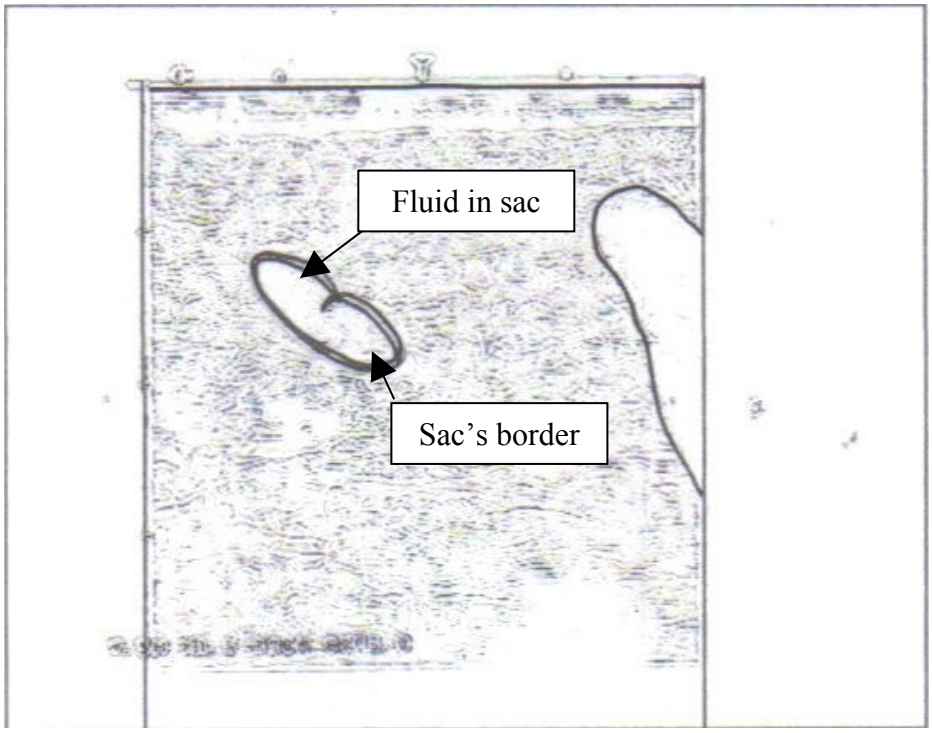
(A)



(B)

Figure 4.2: Image (A) is a original image. Non-echogenic (NE) area was detected on day 23 of gestation (early stage). Image (B) is a labeled image.

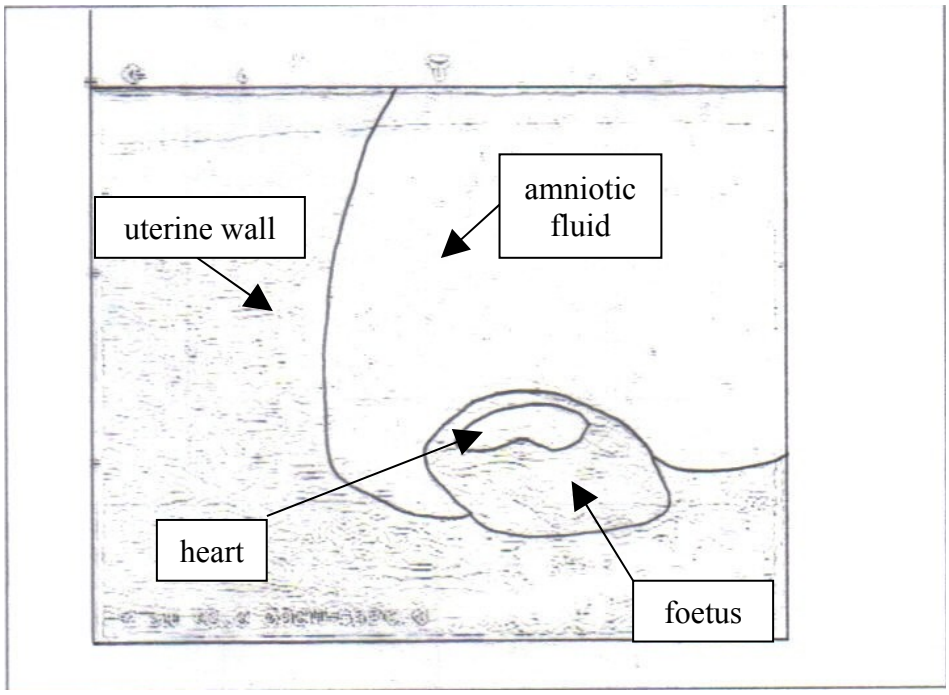
(A)



(B)

Figure 4.3: Image (A) is an original image. Sac was detected on day 25 of gestation (early stage). Image (B) is a labeled image.

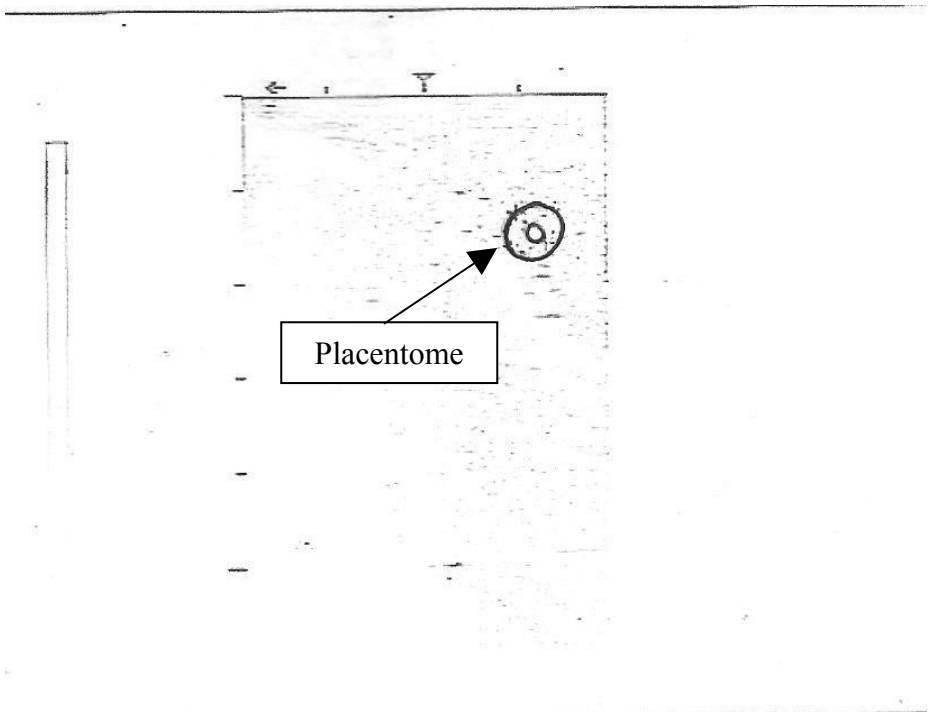
(A)



(B)

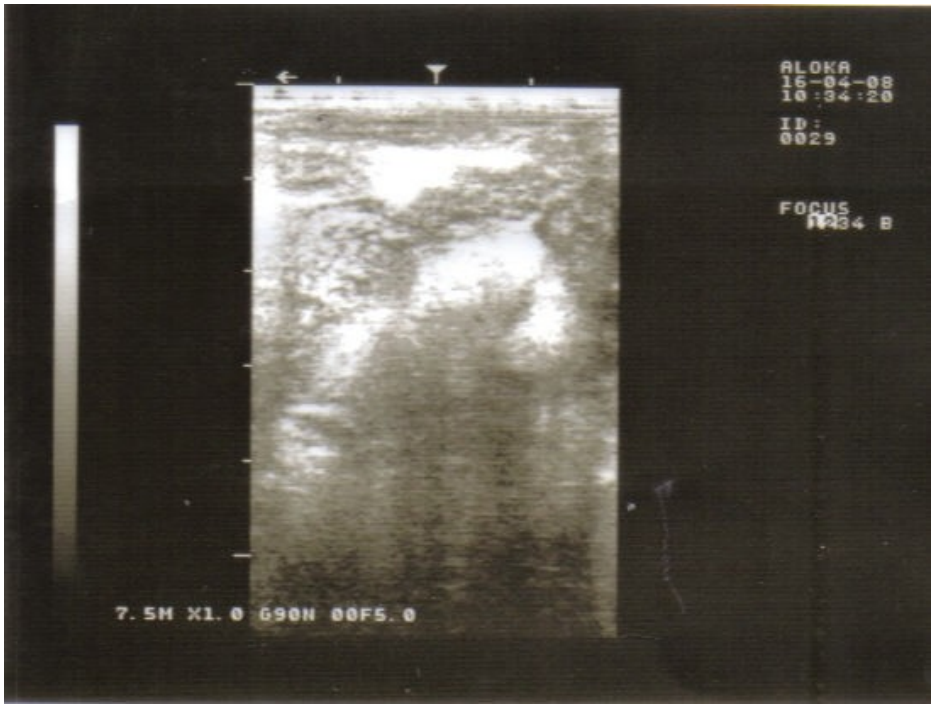
Figure 4.4: Image (A) is an original image. Foetus-heartbeat-uterine wall-amniotic fluid was detected on day 28 of gestation (early stage). Image (B) is a labeled images.

(A)

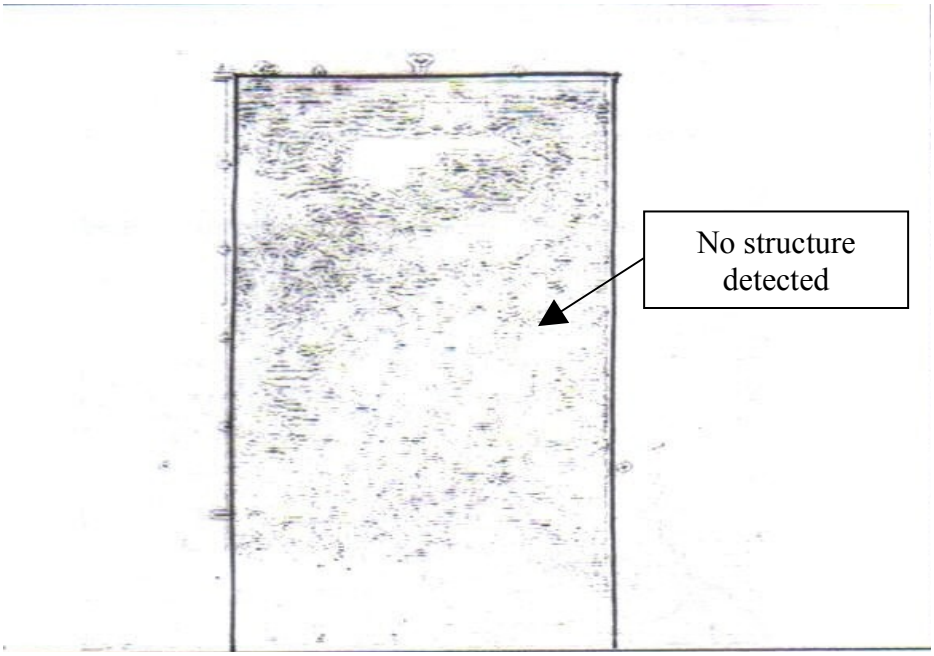


(B)

Figure 4.5: Image (A) is an original image. Placentome was detected on day 29 of gestation (early stage). Image (B) is a labeled image.



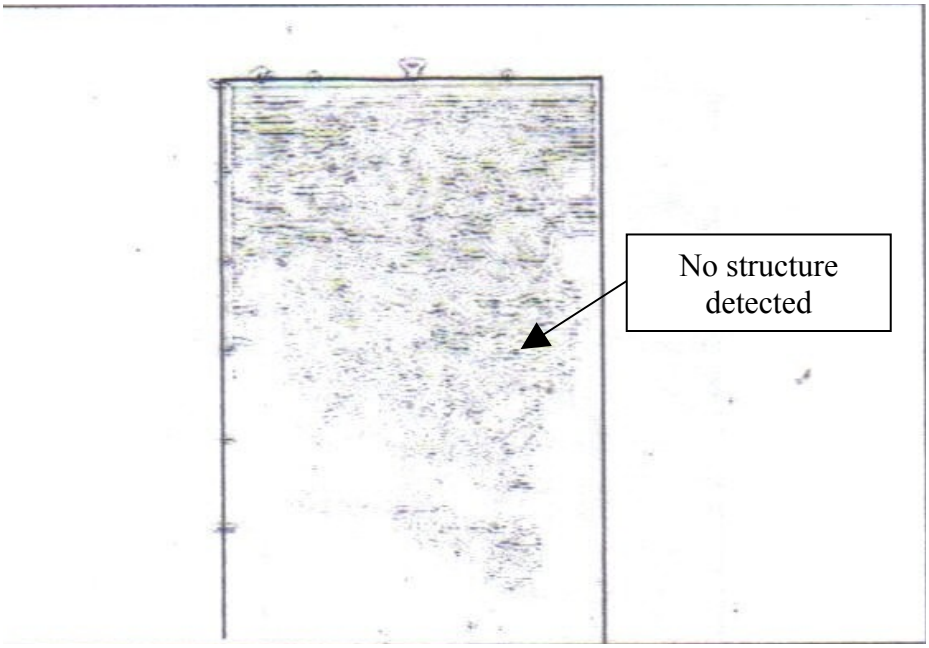
(A)



(B)

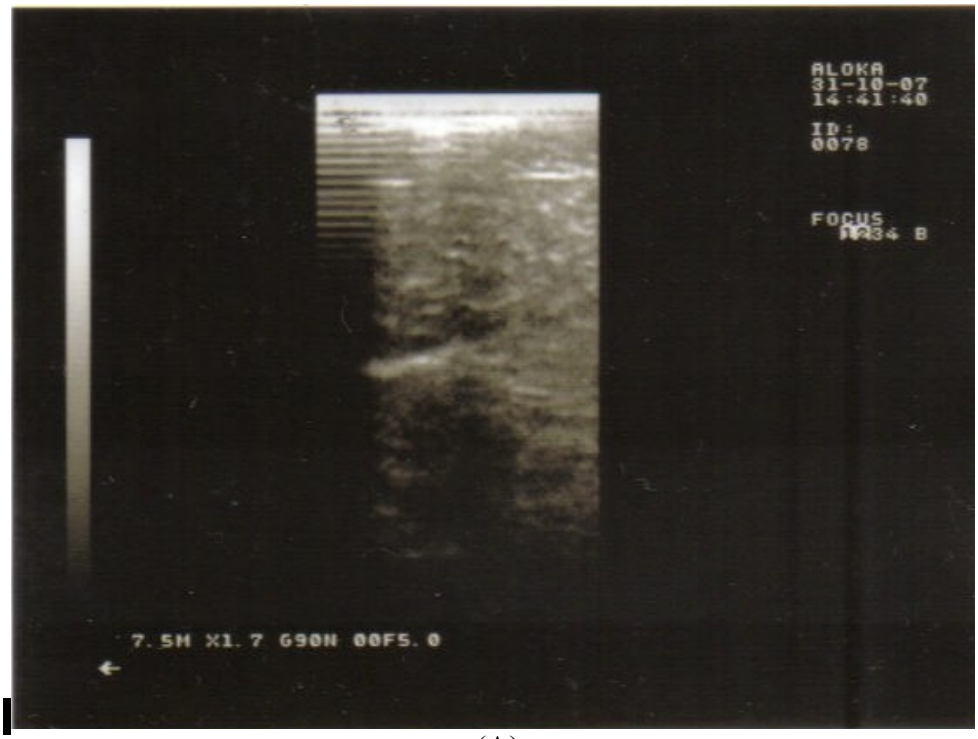
Figure 4.6: Image (A) is an original image. No significant structure was detected on day 51 of gestation (middle stage). Image (B) is a labeled image.

(A)

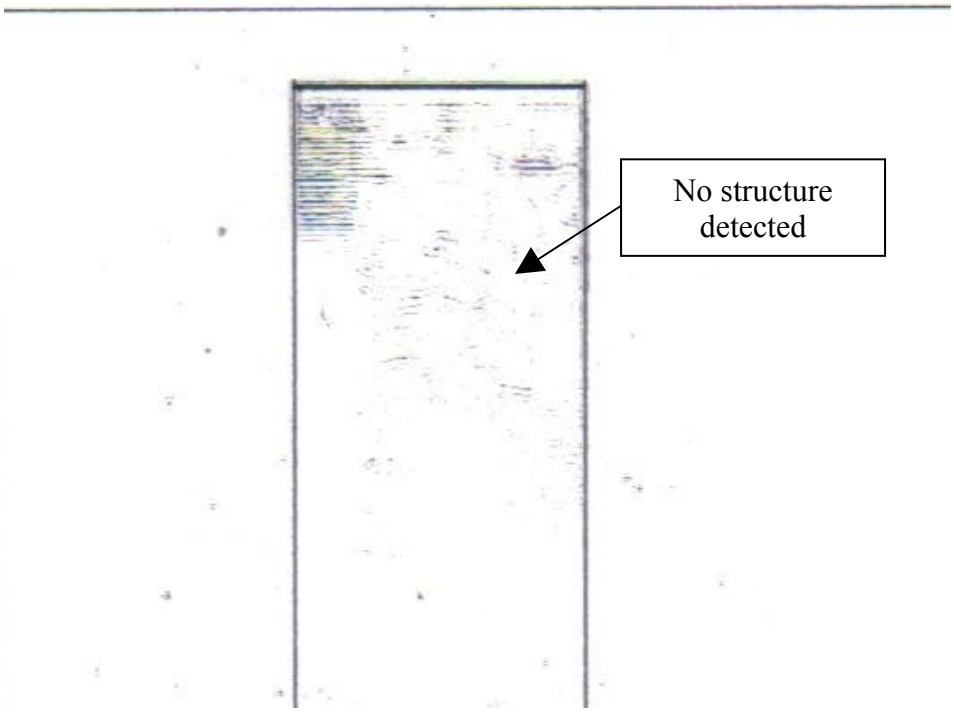


(B)

Figure 4.7: Image (A) is an original image. No significant structure was detected on day 66 of gestation (middle stage). Image (B) is a labeled image.



(A)



(B)

Figure 4.8: Image (A) is an original image. No significant structure was detected on day 70 of gestation (middle stage). Image (B) is a labeled image.

4.2 OVERVIEW OBSERVATION ON FOETAL DEVELOPMENT AND RELATED IMAGES IN REPRODUCTIVE SYSTEM IN DOES USING TRANSABDOMINAL PROBE (EXPERIMENT 2)

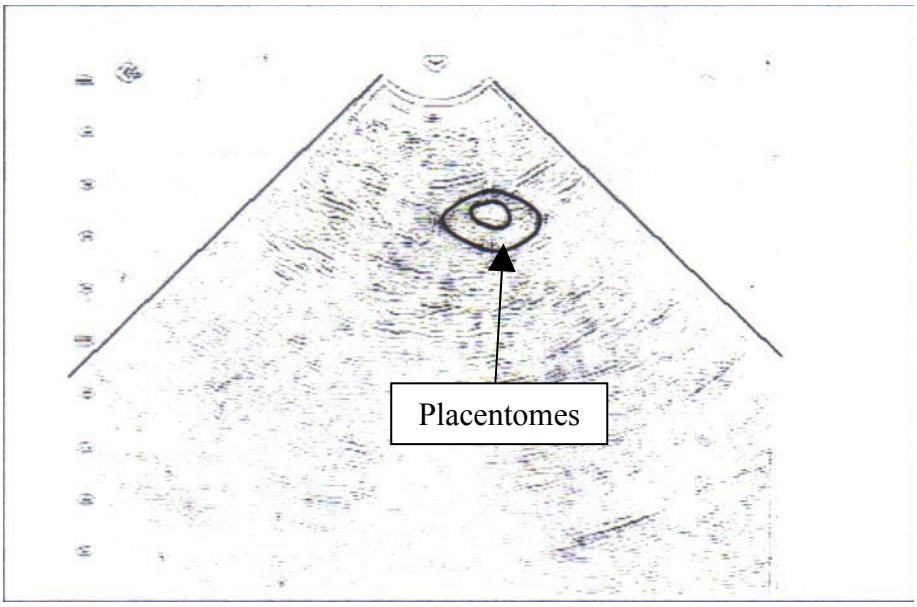
In this experiment, images of different structures were observed during later stages of pregnancy. Table 4.2 presents images of foetus along gestation period obtained from ultrasound scanning using 5.0 MHz transabdominal probe. The earliest indicator observed was placentomes which were detected as early as day 51 of gestation, i.e. during middle stage of pregnancy (Figure 4.9). In addition, foetus-placentomes images were detected on day 66 of pregnancy (Figures 4.10- 4.11). Other structures such as spinal cord were detected from day 70 of gestation (Figure 4.12). Images on days 108 and 117 (late stage of pregnancy) showed foetus-heartbeat-spinal cord-ribs-foetal organs (Figure 4.13). Placentomes were also observed on days 123 to 142 of gestation (Figures 4.14- 4.15). In contrast to the results obtained in Experiment 1 using the transrectal probe (Section 4.1), no specific image indicators were found using transabdominal probe at early stages of pregnancy, i.e. on days 13 to 30 of gestation (Figures 4.16-4.18).

Table 4.2: Images of foetal and related structures during gestation period using 5.0 MHz transabdominal probe

Day of pregnancy	Predicted pregnancy	Placentome	Foetus	Uterine wall	Amniotic fluid	Heartbeat	Spinal cord	Limbs	Ribs	Head	Foetal organ
13	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-
51	+	+	-	-	-	-	-	-	-	-	-
66	+	+	+	-	+	+	-	-	+	-	-
70	+	+	+	-	+	+	+	-	+	-	-
86	+	-	+	-	+	+	+	-	+	-	-
108	+	-	+	-	+	+	+	-	+	-	+
117	+	+	+	-	+	+	+	-	+	-	+
123	+	+	-	-	-	-	-	-	-	-	-
133	+	+	-	-	-	-	-	-	-	-	-
142	+	+	-	-	-	-	-	-	-	-	-

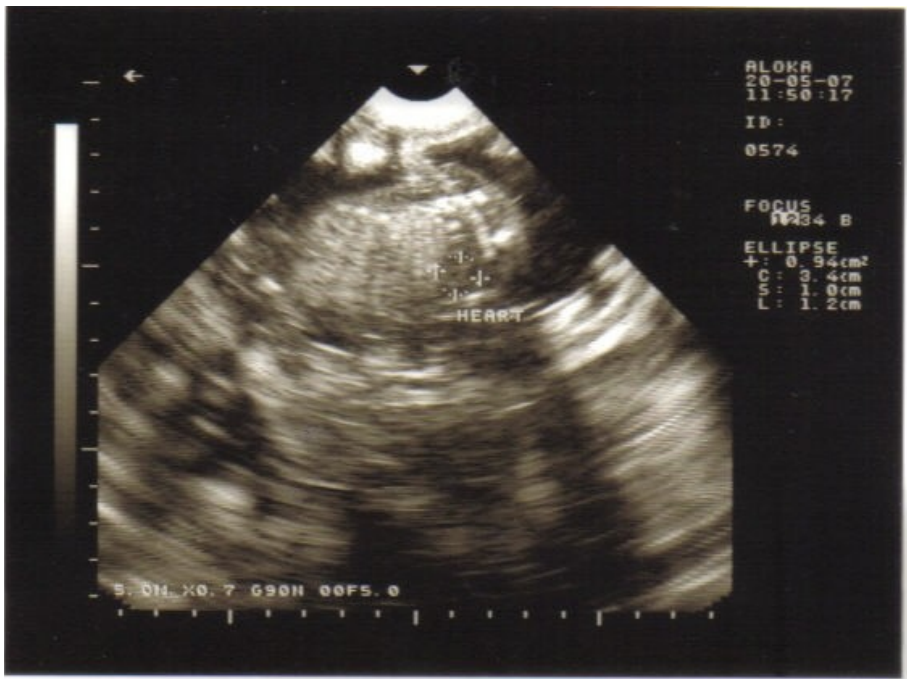
+ = predicted positive pregnancy indicator
- = predicted negative pregnancy indicator

(A)

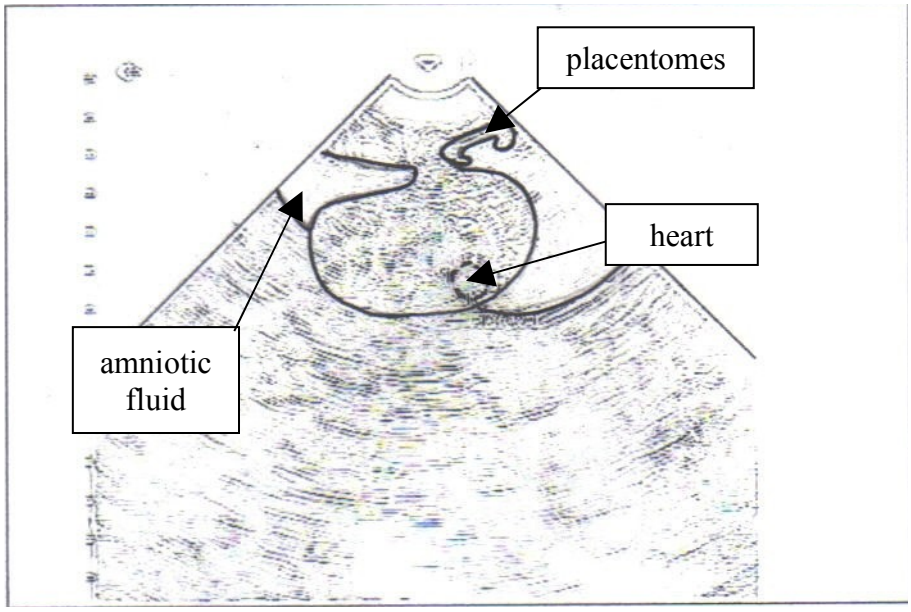


(B)

Figure 4.9: Image (A) is an original image. Placentomes were detected on day 51 of gestation (middle stage). Image (B) is a labeled image.



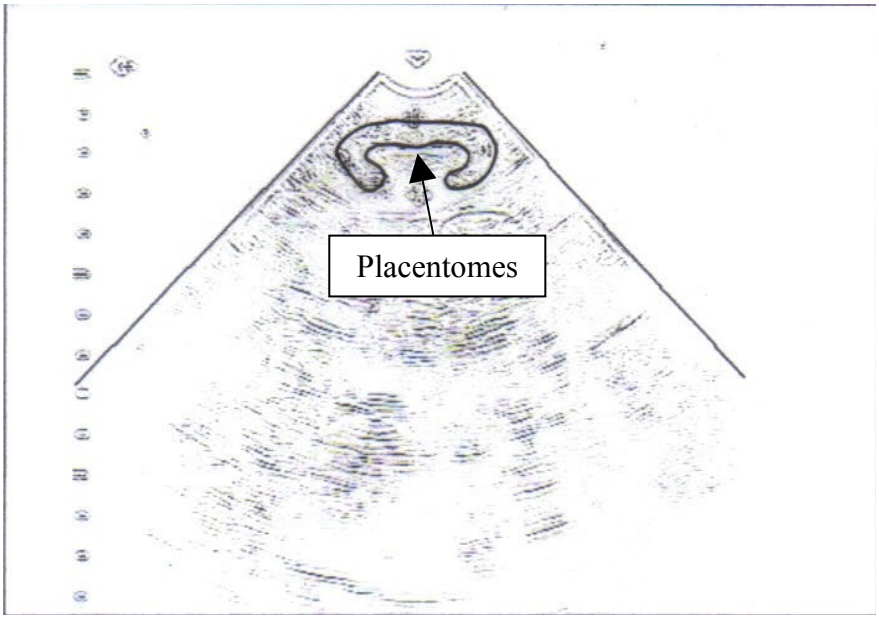
(A)



(B)

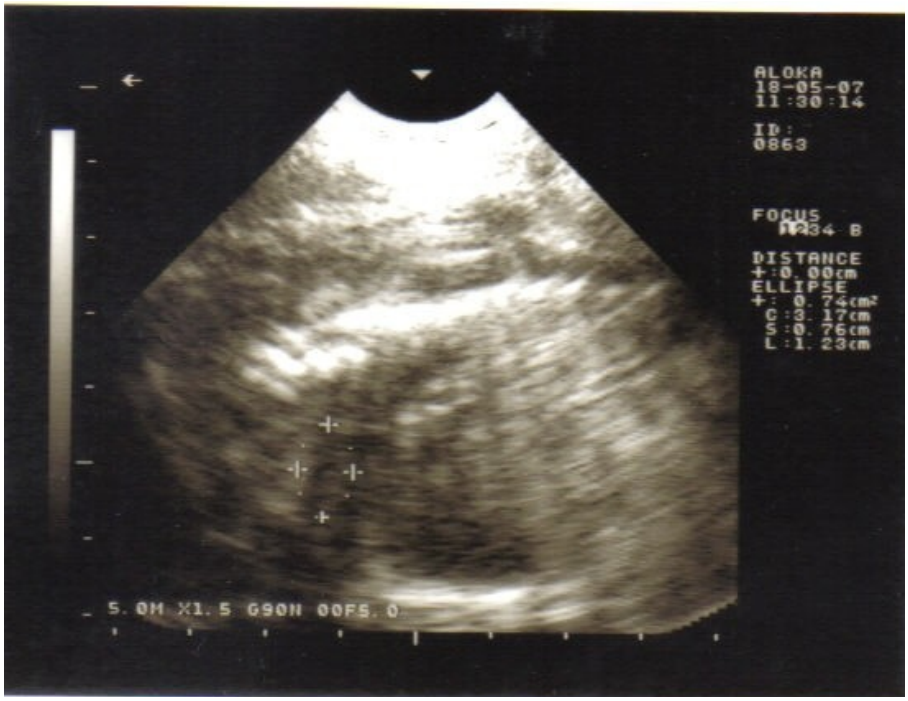
Figure 4.10: Image (A) is an original image. Foetus with heartbeat and amniotic fluid were detected on day 66 of gestation (middle stage). Image (B) is a labeled image.

(A)

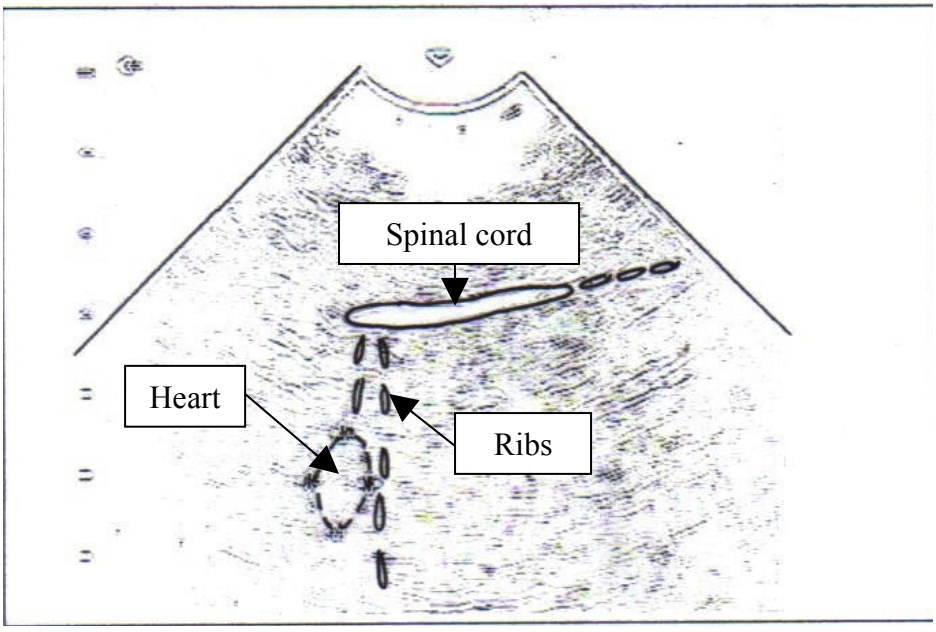


(B)

Figure 4.11: Image (A) is an original image. Placentomes were detected on day 66 of gestation (middle stage). Image (B) is a labeled image.

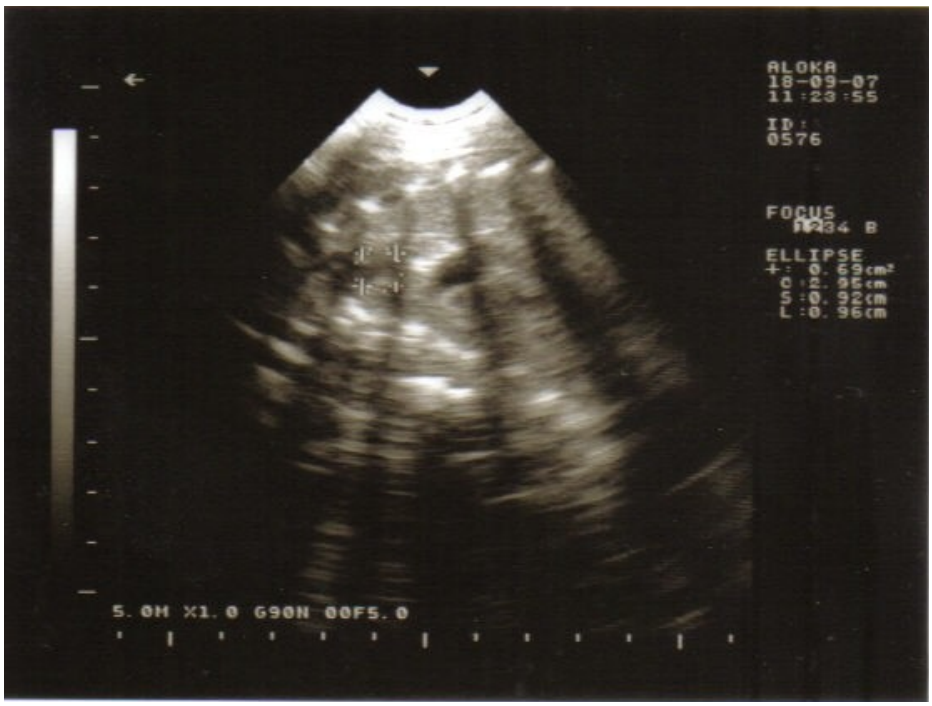


(A)

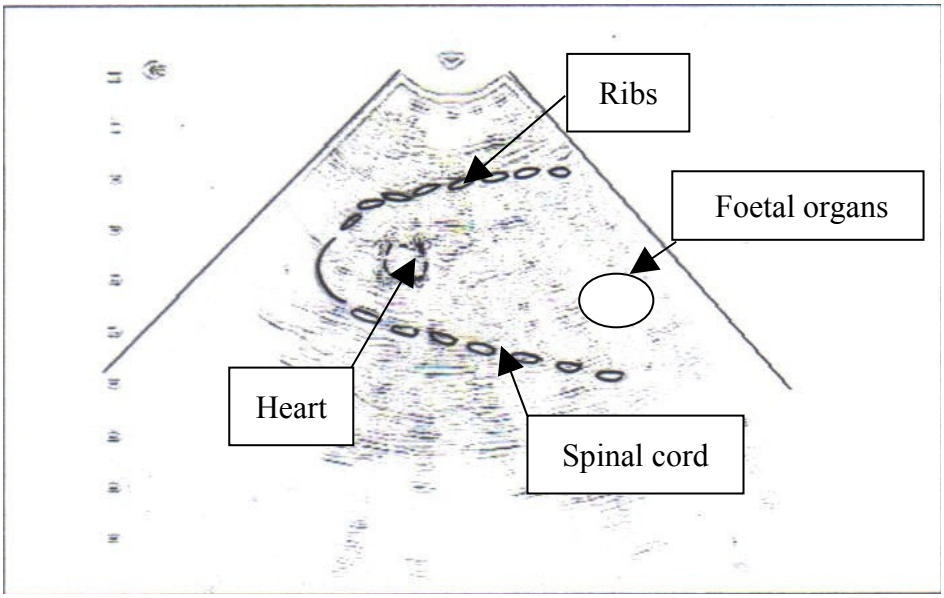


(B)

Figure 4.12: Image (A) is an original image. Foetus, ribs, spinal cord and heartbeat were detected on day 86 of gestation (late stage). Image (B) is a labeled image.



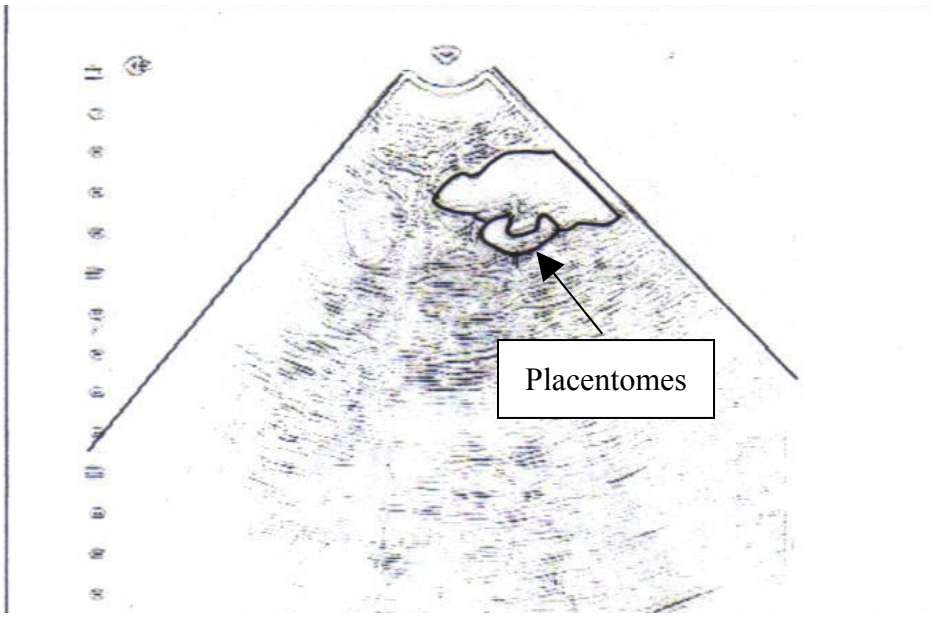
(A)



(B)

Figure 4.13: Image (A) is an original image. Foetus, ribs, spinal cord, heartbeat and foetal organs were detected on day 108 of gestation (late stage). Image (B) is a labeled image.

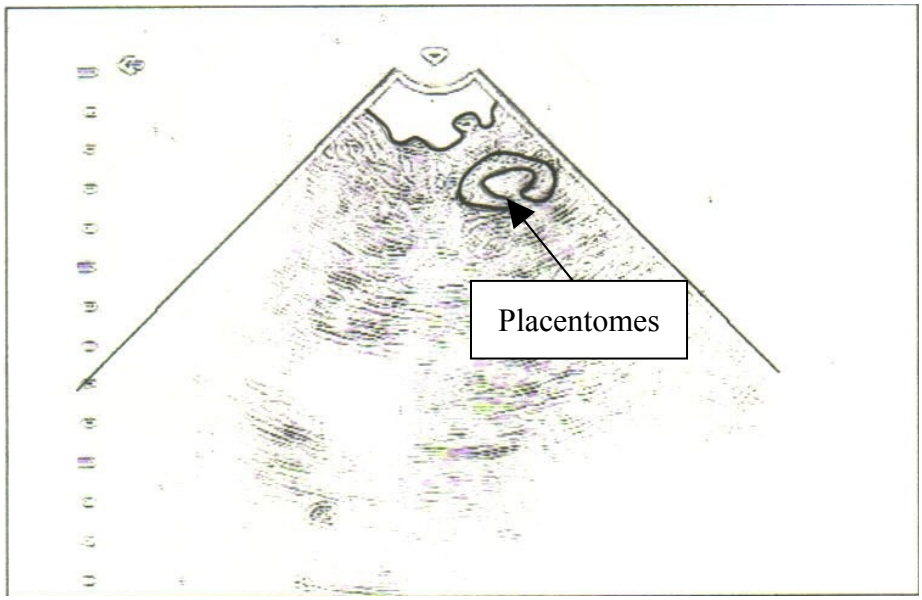
(A)



(B)

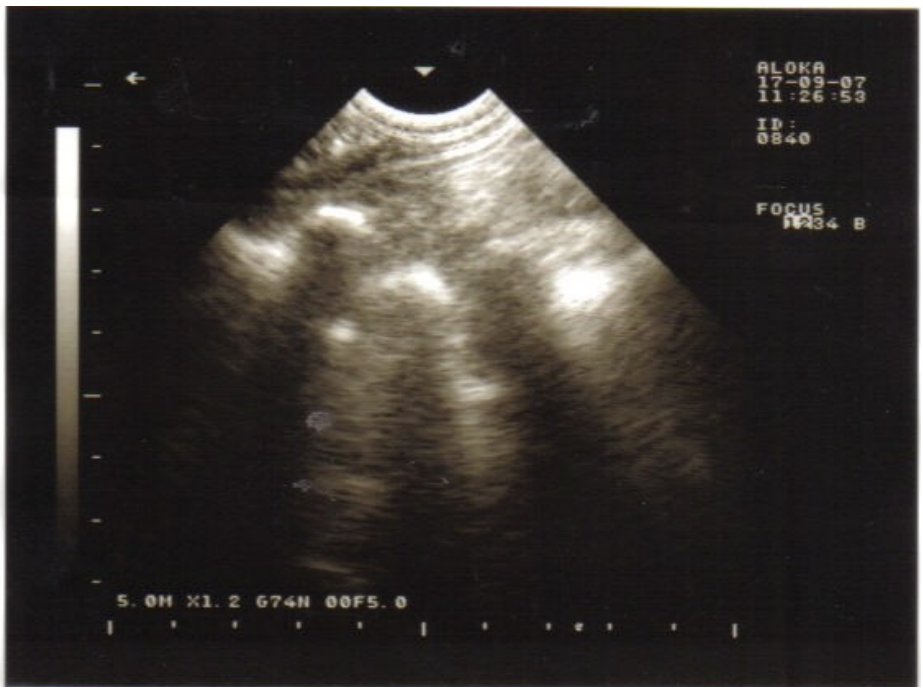
Figure 4.14: Image (A) is an original image. Placentomes were detected on day 123 of gestation (final stage). Image (B) is a labeled image.

(A)

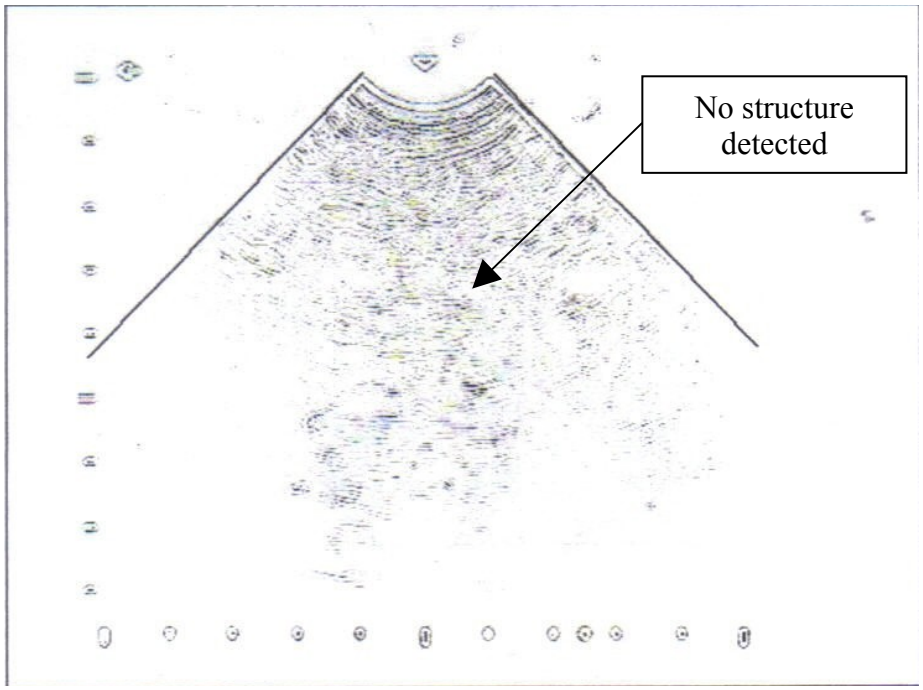


(B)

Figure 4.15: Image (A) is an original image. Placentomes were detected on day 133 of gestation (final stage). Image (B) is a labeled image.

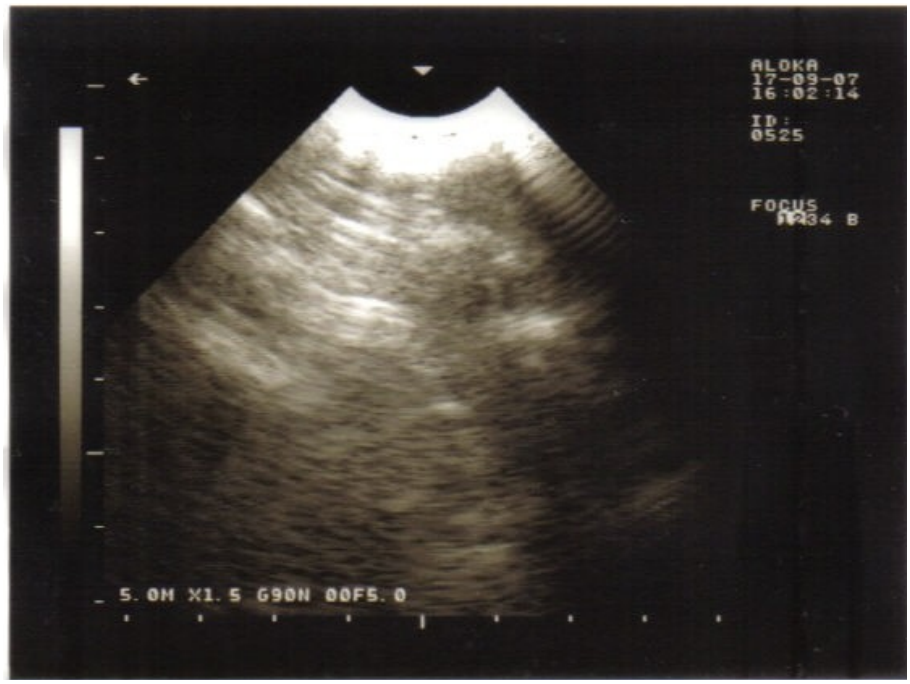


(A)

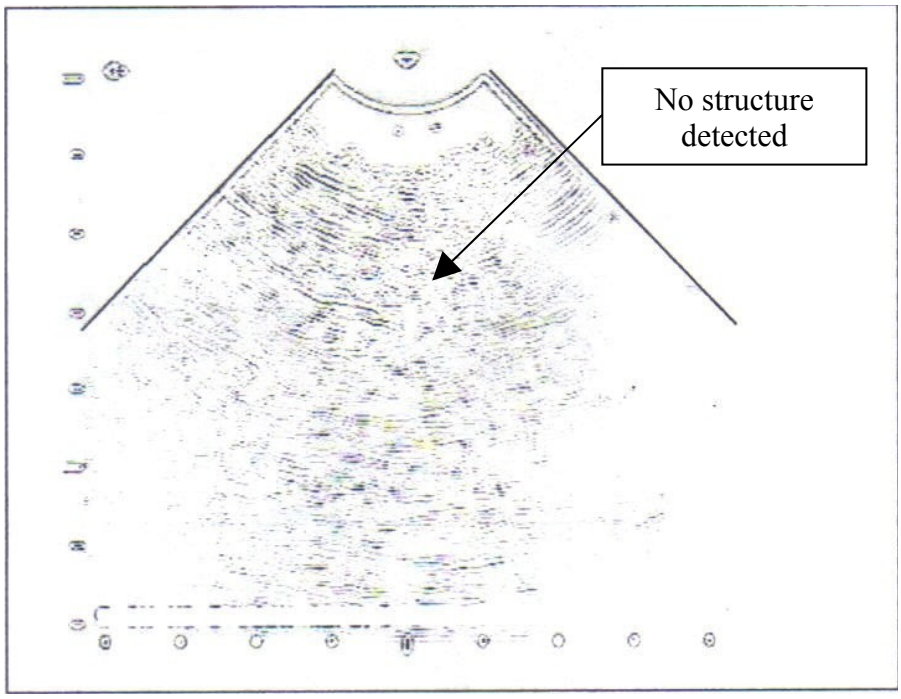


(B)

Figure 4.16: Image (A) is an original image. No indicator was detected on day 13 of gestation (initial stage). Image (B) is a labeled image.

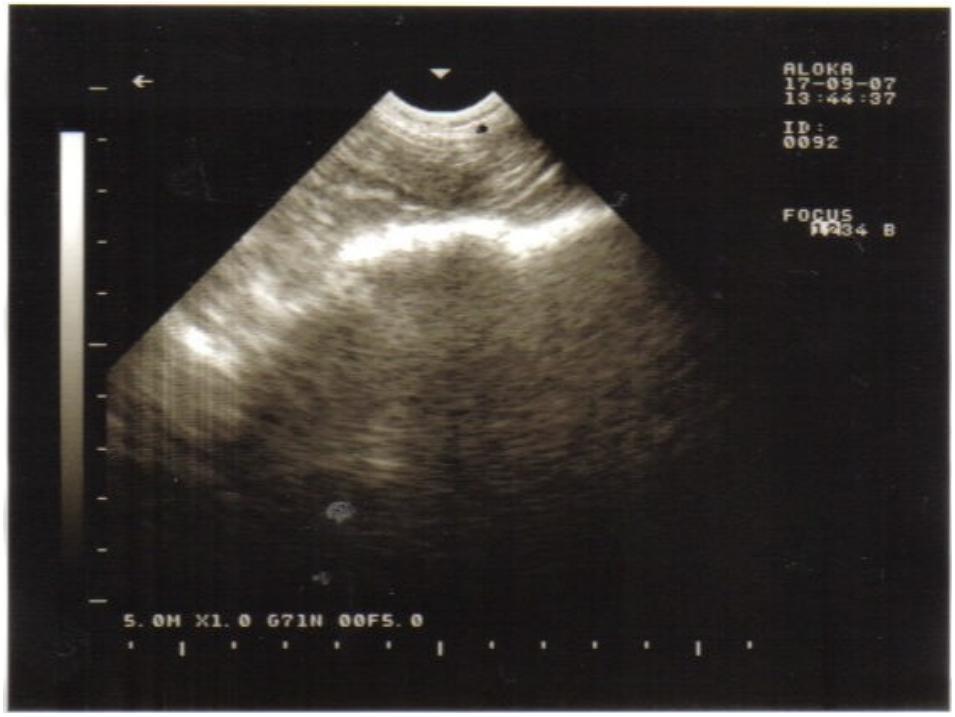


(A)

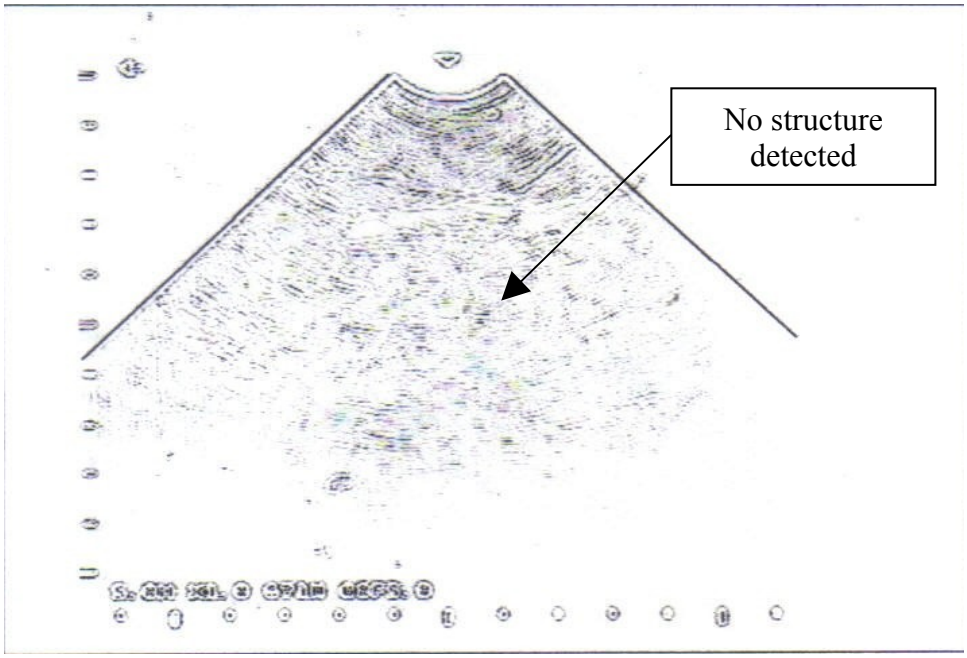


(B)

Figure 4.17: Image (A) is an original image. No indicator was detected on day 25 of gestation (early stage). Image (B) is a labeled image.



(A)



(B)

Figure 4.18: Image (A) is an original image. No indicator was detected on day 28 of gestation (early stage). Image (B) is a labeled image.

4.3 OPTIMIZATION OF PREGNANCY DIAGNOSIS OF DOES USING TRANSRECTAL PROBE (EXPERIMENT 3)

Table 4.3 shows pregnancy indicators observed using 7.5 MHz transrectal probe along gestation period. Indicators were labeled alphabetically (i.e. each alphabet refers to individual doe) to ease separating each image captured on different does at the estimated day of gestation. The earliest sac was detected in a doe on day 16 of gestation. However, sacs were detected from days 21 to 27 of gestation in all other does involved in this experiment (Figure 4.19). Non-echogenic (NE) areas were also observed from days 20 to 24 of pregnancy (Figures 4.20-4.21). Placentomes were observed on day 30 of gestation (Figure 4.22). During early stage, combination of foetus-heartbeat-uterine wall-amniotic fluid was detected from days 26 to 44 of gestation (Figures 4.23-4.24). Foetus with heartbeat was detected on day 27 of gestation. There was no indicator or structure observed from day 54 onwards (Figure 4.25). Table 4.4 shows a summary of image observed for specific structure or combination of structures with number of does along gestation period. For early stage of pregnancy, pregnancy predictive value (percentage) for singular indicators, i.e. sac, non-echogenic (NE) area, placentomes, foetus, heartbeat, amniotic fluid and uterine wall were 15, 13, 2, 20, 20, 15 and 15%, respectively (Figure 4.26). Combination of foetus-heartbeat, foetus-heartbeat-uterine wall-amniotic fluid and singular indicators, i.e. sac, non-echogenic (NE) area and placentomes, the pregnancy predictive percent were 7, 31, 31, 27 and 4%, respectively (Figure 4.27). Frequency of singular structural images was observed along gestation period in Figure 4.28. Non-echogenic (NE) area occurrences were twice and 5 times on days 16-20 and 21-25 of gestation, respectively. Occurrences of sac were once, 6 times and twice on days 16-20, 21-25 and 26-31 of gestation, respectively. Occurrences for placentomes, foetus, heartbeat, amniotic fluid and uterine wall were once, 6 times, 6 times, 4 times and 4 times on days 26-31 of gestation, respectively. Foetus, heartbeat,

amniotic fluid and uterine wall each occurred 4 times on days 32-44 of gestation. Figure 4.29 shows frequency of selected structural images (singular and combination of structures) observed on early stage of gestation. Occurrences for NE area on days 16-25 was 7 times. Occurrences of sac on days 16-25 and 26-31 were 7 times and twice, respectively. Foetus-heartbeat occurred twice on days 26-31 of gestation. Occurrences of foetus-heartbeat-uterine wall-amniotic fluid were 4 times on days 26-31 and 32-44 of gestation, respectively. The sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy with numbers of does along gestation period are shown in Table 4.5. The sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy for initial stage were 100, 40, 25, 100 and 66%, respectively. Early stage of gestation gave 96, 100, 100, 80 and 94% of sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy, respectively.

Table 4.3: Images on indicators along pregnancy period (stage and day of pregnancy) using 7.5 MHz transrectal probe

Stage of pregnancy	Day of pregnancy	N	Indicator	Sac	Non-ehogenic (NE) area**	Placentome	Foetus	Uterine wall	Amniotic fluid	Heartbeat
Initial (days 1-21)	15	1	-	-	-	-	-	-	-	-
	16	2*	+	+ (a)	-	-	-	-	-	-
	18	1	-	-	-	-	-	-	-	-
Early (days 22-49)	20	2*	-	-	+ (a,b)	-	-	-	-	-
	21	3*	+	+ (a,b)	+ (c)	-	-	-	-	-
	22	2*	+	-	+ (a,b)					
	23	3*	+	+ (a,b)	+ (c)	-	-	-	-	-
	24	3*	+	+ (a,b)	+ (c)					
	26	2*	+	+ (a)	-	-	+ (b)	+ (b)	+ (b)	+ (b)
	27	2*	+	+ (a)	-	-	+ (b)	-	-	+ (b)
	28	2*	+		-	-	+ (a,b)	+ (a)	+ (a)	+ (a,b)
	29	1	+	-	-	-	+	+	+	+
	30	1	+	-	-	+	-	-	-	-
	31	1	+	-	-	-	+	+	+	+
	36	1	+	-	-	-	+	+	+	+
	38	1	+	-	-	-	+	+	+	+
	40	1	+	-	-	-	+	+	+	+
	44	1	+	-	-	-	+	+	+	+

(continued)

(continued)

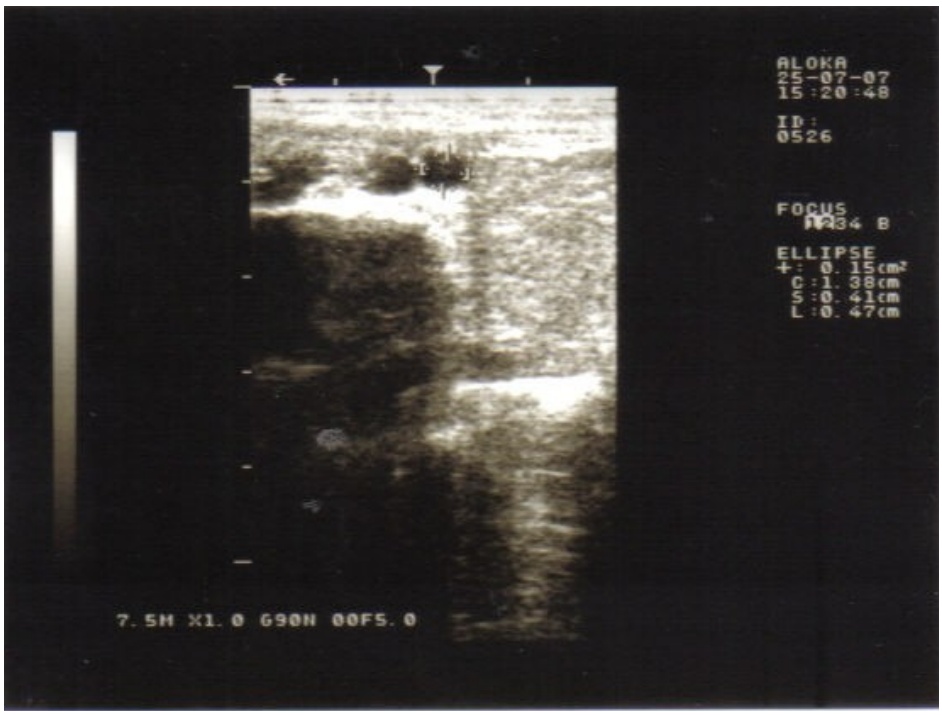
Stage of pregnancy	Day of pregnancy	N	Indicator	Sac	Non-echogenic (NE) area**	Placentome	Foetus	Uterine wall	Amniotic fluid	Heartbeat
Middle (days 50-83)	54	1	-	-	-	-	-	-	-	-
	56	1	-	-	-	-	-	-	-	-
	58	1	-	-	-	-	-	-	-	-
	60	1	-	-	-	-	-	-	-	-
	61	1	-	-	-	-	-	-	-	-
	63	1	-	-	-	-	-	-	-	-
	66	2*	-	-	-	-	-	-	-	-
	71	1	-	-	-	-	-	-	-	-
	72	1	-	-	-	-	-	-	-	-
	76	2*	-	-	-	-	-	-	-	-
	83	2*	-	-	-	-	-	-	-	-
Late (days 84-119)	84	1	-	-	-	-	-	-	-	-
	87	1	-	-	-	-	-	-	-	-
	91	1	-	-	-	-	-	-	-	-
	92	1	-	-	-	-	-	-	-	-
	93	1	-	-	-	-	-	-	-	-
	94	1	-	-	-	-	-	-	-	-
	95	1	-	-	-	-	-	-	-	-
	96	1	-	-	-	-	-	-	-	-
	97	1	-	-	-	-	-	-	-	-
	99	1	-	-	-	-	-	-	-	-
	105	1	-	-	-	-	-	-	-	-
	106	1	-	-	-	-	-	-	-	-
	108	1	-	-	-	-	-	-	-	-
	112	1	-	-	-	-	-	-	-	-
	114	1	-	-	-	-	-	-	-	-
	115	1	-	-	-	-	-	-	-	-

(continued)

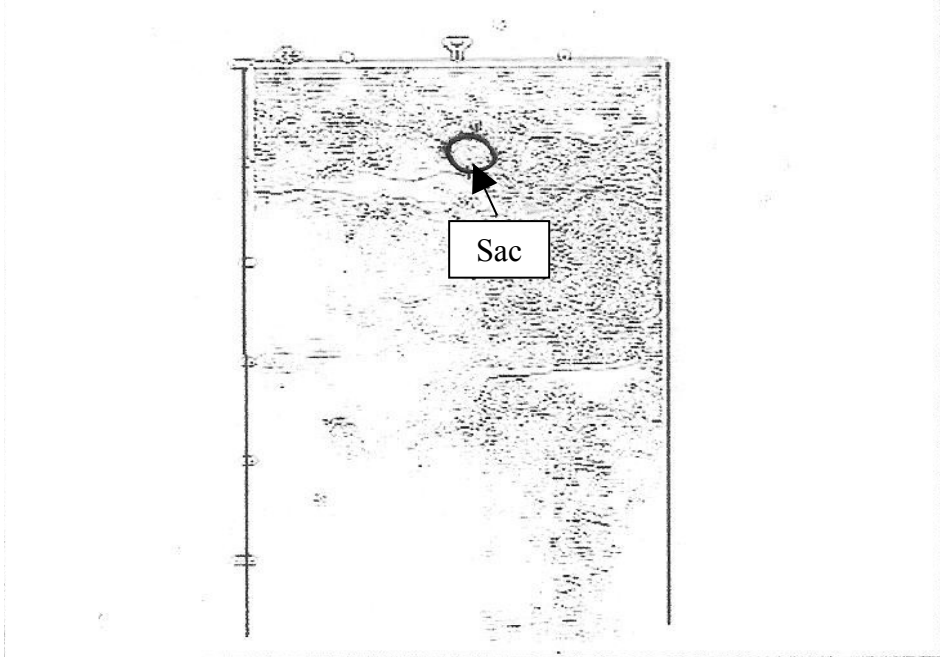
(continued)

	Day of pregnancy	N	Indicator	Sac	Non-echogenic (NE) area**	Placentome	Foetus	Uterine wall	Amniotic fluid	Heartbeat
	117	1	-	-	-	-	-	-	-	-
Final (days 120-147)	120	1	-	-	-	-	-	-	-	-
	121	1	-	-	-	-	-	-	-	-
	124	1	-	-	-	-	-	-	-	-
	127	1	-	-	-	-	-	-	-	-
	130	1	-	-	-	-	-	-	-	-
	146	1	-	-	-	-	-	-	-	-
Total		**67**								

+ = predicted positive pregnancy indicator
- = predicted negative pregnancy indicator
* Observation was based on individual does on same days of gestation (assumption 147 days of gestation length)
** expected structures were allantoic fluid and amniotic fluid
N= number of does

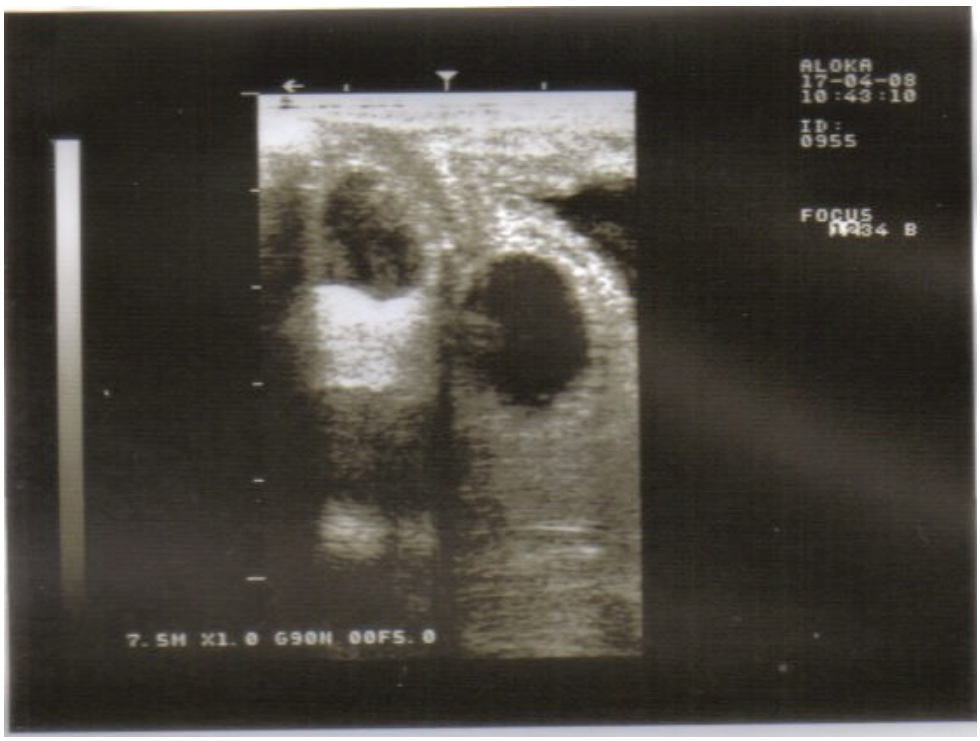


(A)

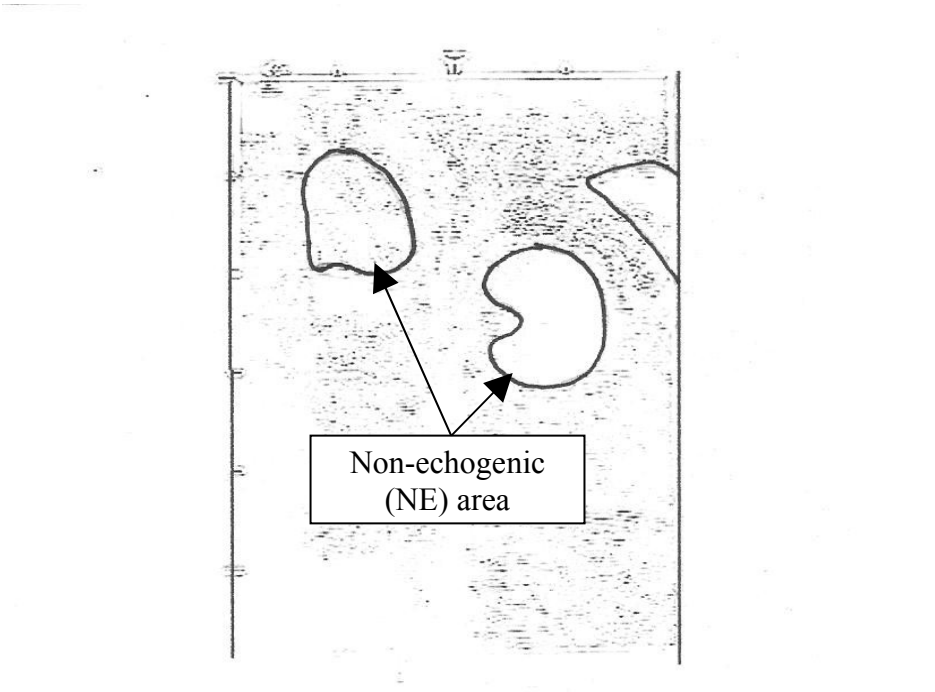


(B)

Figure 4.19: Image (A) is an original image. Sac was detected on day 21 of gestation (early stage). Image (B) is a labeled image.

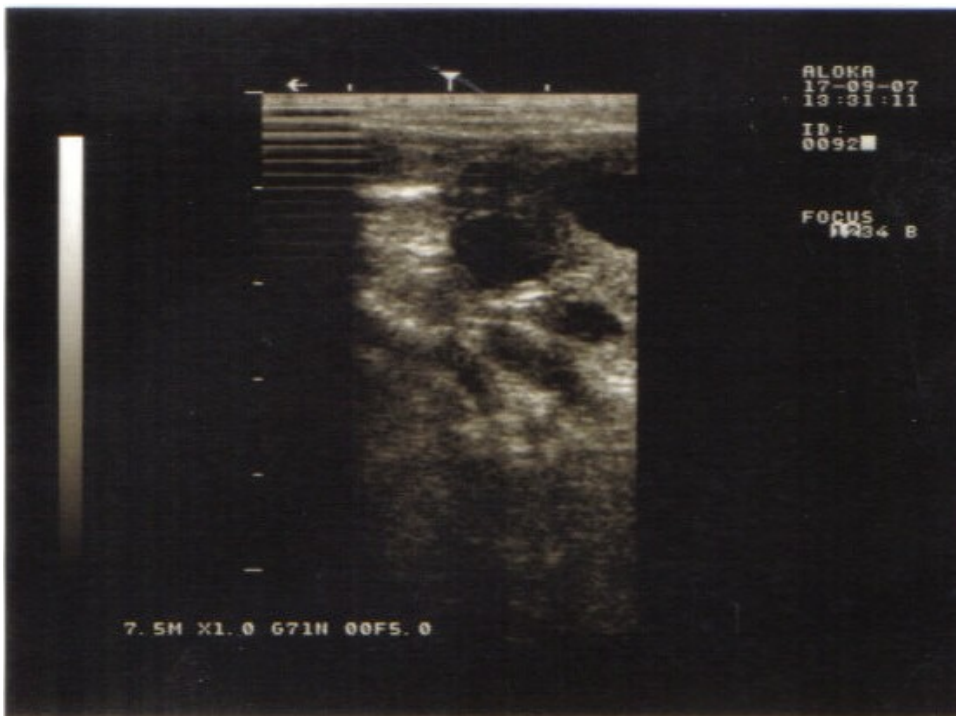


(A)

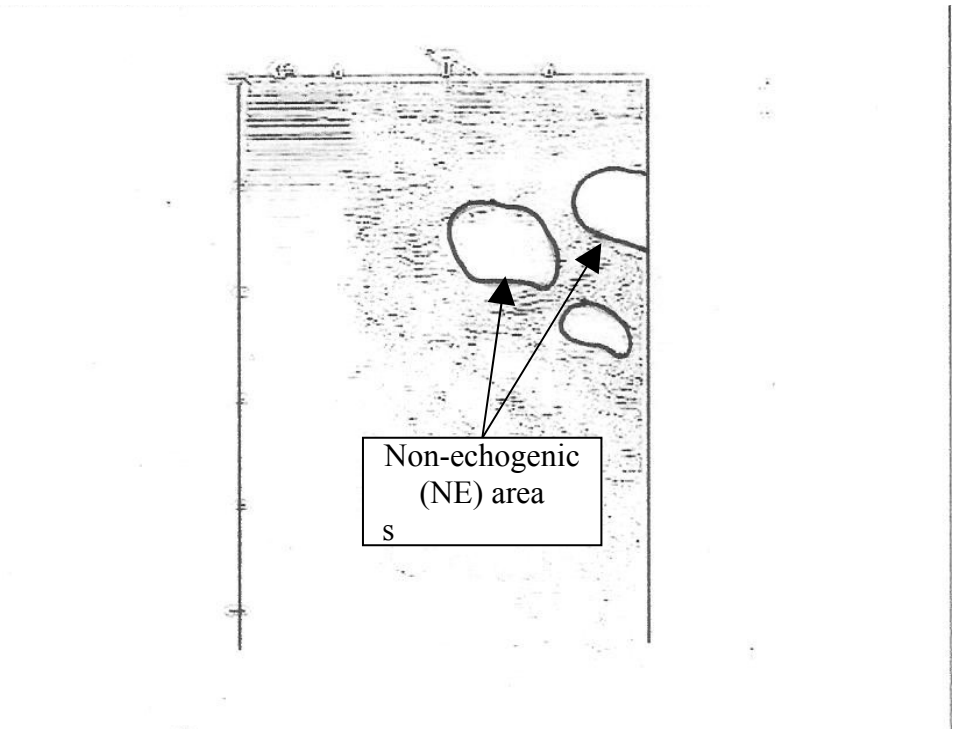


(B)

Figure 4.20: Image (A) is an original image. Non-echogenic (NE) area was detected on day 20 of gestation (early stage). Image (B) is a labeled image.



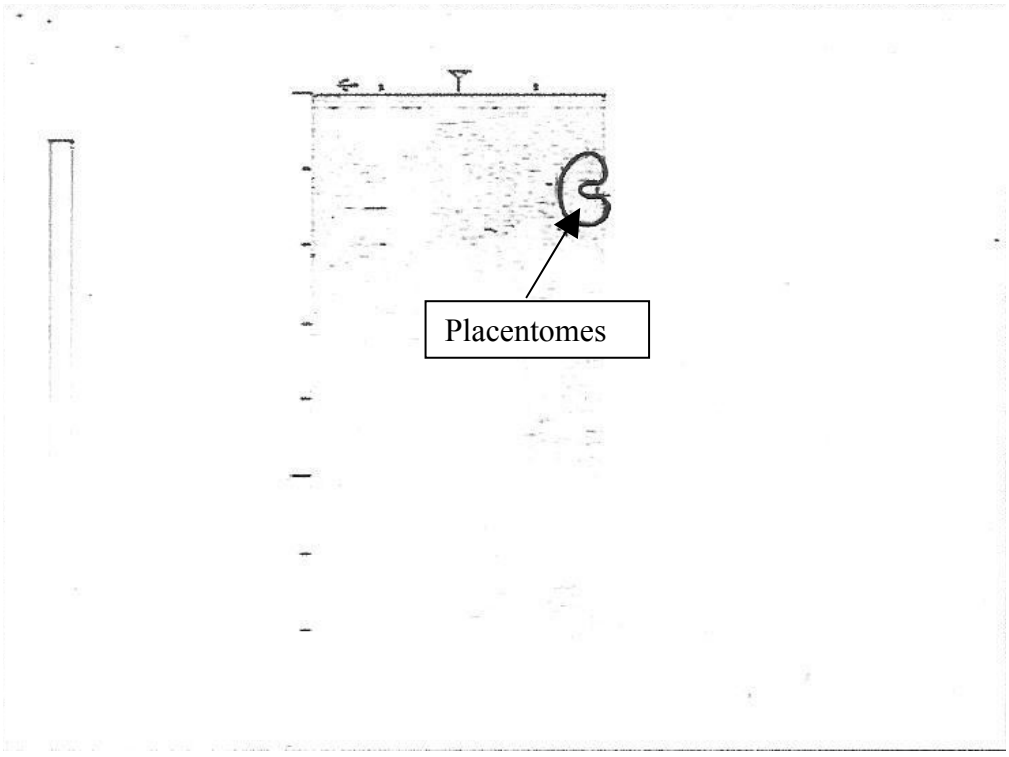
(A)



(B)

Figure 4.21: Image (A) is an original image. Non-echogenic area was detected on day 21 of gestation (early stage). Image (B) is a labeled image.

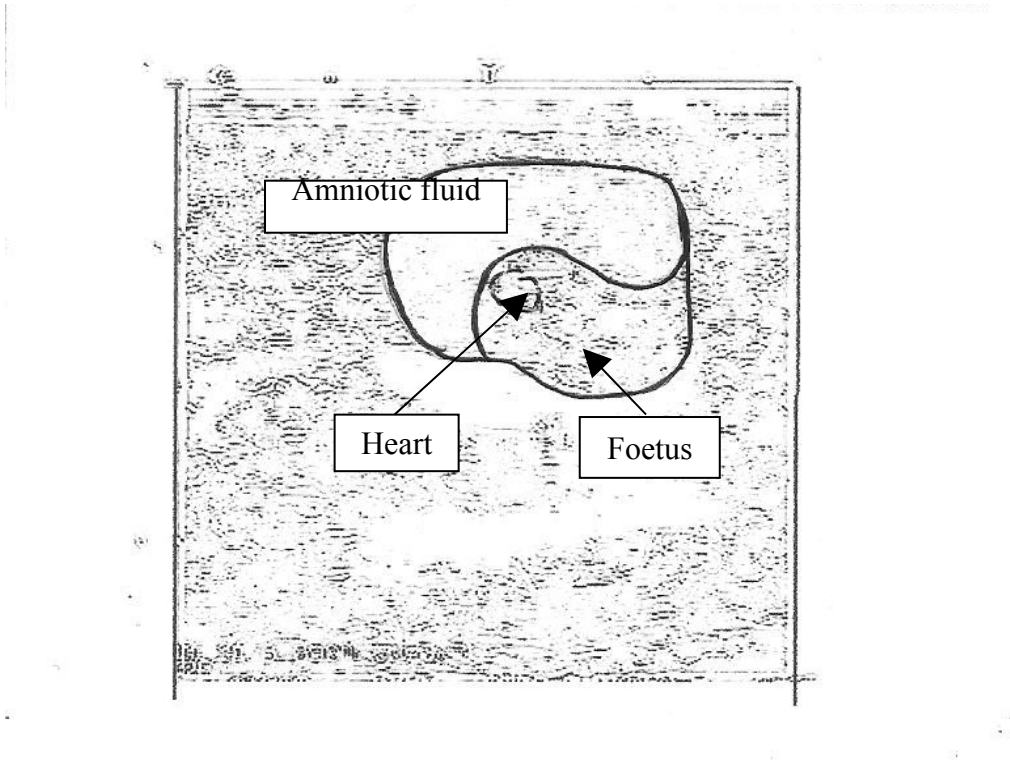
(A)



(B)

Figure 4.22: Image (A) is an original image. Placentomes were detected on day 30 of gestation (early stage). Image (B) is a labeled image.

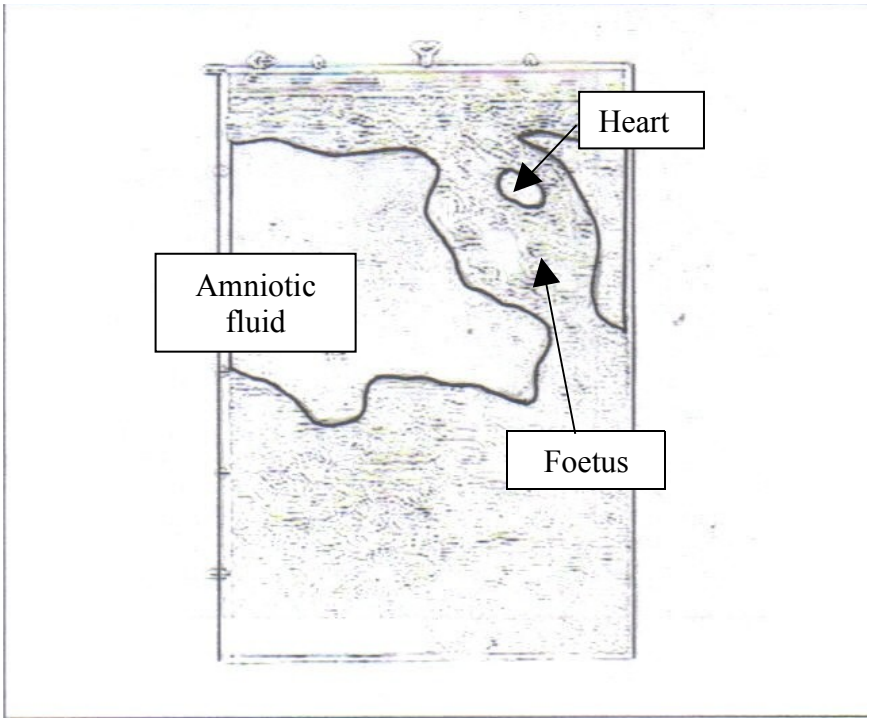
(A)



(B)

Figure 4.23: Image (A) is an original image. Foetus with uterine wall, amniotic fluid and heartbeat were detected on day 26 of gestation (early stage). Image (B) is a labeled image.

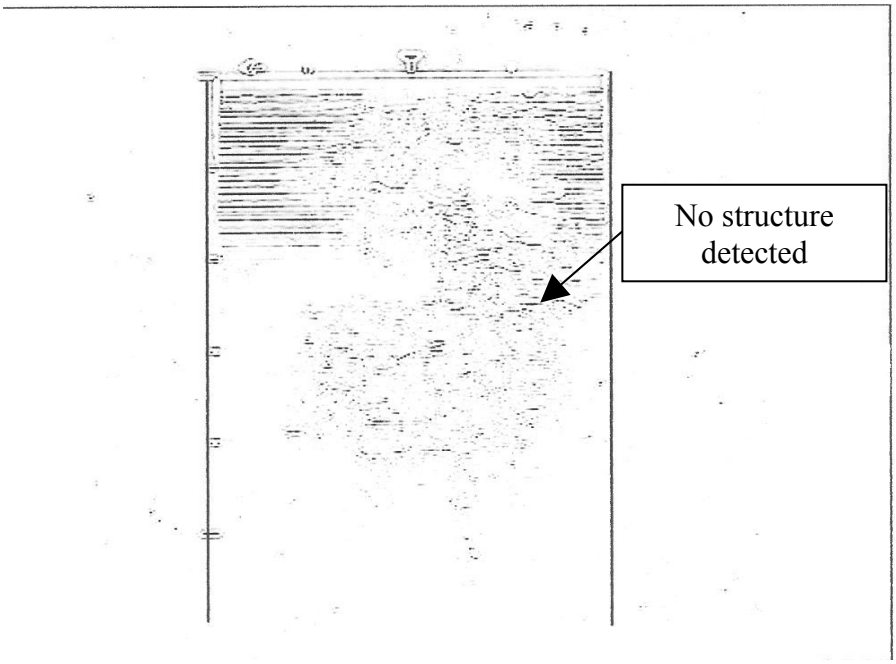
(A)



(B)

Figure 4.24: Image (A) is an original image. Foetus with heartbeat and amniotic fluid were detected on day 28 of gestation (early stage). Image (B) is a labeled image.

(A)



(B)

Figure 4.25: Image (A) is an original image. No indicator was detected on day 54 of gestation (middle stage). Image (B) is a labeled image.

Table 4.4: Summary of image observation for each structure/combination of structures using transrectal probe during gestation period

Day of pregnancy	N	Specific structures/combination structure								
		Sac	Non-echogenic (NE) area	Placentome	Foetus	Heartbeat	Amniotic fluid	Uterine wall	Foetus x heartbeat	Foetus x heartbeat x uterine wall x amniotic fluid
16	1	+	-	-	-	-	-	-	-	-
20	2	-	+	-	-	-	-	-	-	-
21	2	+	-	-	-	-	-	-	-	-
	1	-	+	-	-	-	-	-	-	-
22	2	-	+	-	-	-	-	-	-	-
23	2	+	-	-	-	-	-	-	-	-
	1	-	+	-	-	-	-	-	-	-
24	2	+	-	-	-	-	-	-	-	-
	1	-	+	-	-	-	-	-	-	-
26	1	+	-	-	-	-	-	-	-	-
	1	-	-	-	+	+	+	+	-	+
27	1	+	-	-	-	-	-	-	-	-
	1	-	-	-	+	+	-	-	+	-
28	1	-	-	-	+	+	-	-	+	-
	1	-	-	-	+	+	+	+	-	+
29	1	-	-	-	+	+	+	+	-	+
30	1	-	-	+	-	-	-	-	-	-
31	1	-	-	-	+	+	+	+	-	+
36	1	-	-	-	+	+	+	+	-	+
38	1	-	-	-	+	+	+	+	-	+
40	1	-	-	-	+	+	+	+	-	+
44	1	-	-	-	+	+	+	+	-	+
		9	7	1	10	10	8	8	2	8
Predictive value		20%	13%	2%	20%	20%	15%	15%	-	-
54-146	37	-	-	-	-	-	-	-	-	-

N= number of does

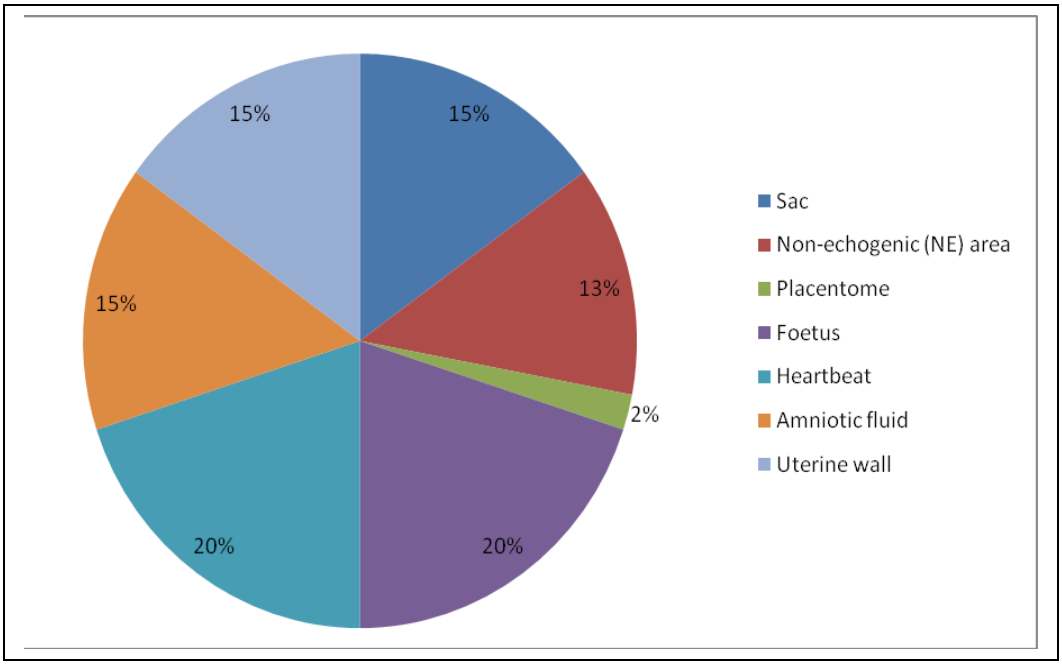


Figure 4.26: Pregnancy predictive value (percentage) for specific structural image detected at early stage of gestation using transrectal probe regardless of singular or combination of structures detected for each doe.

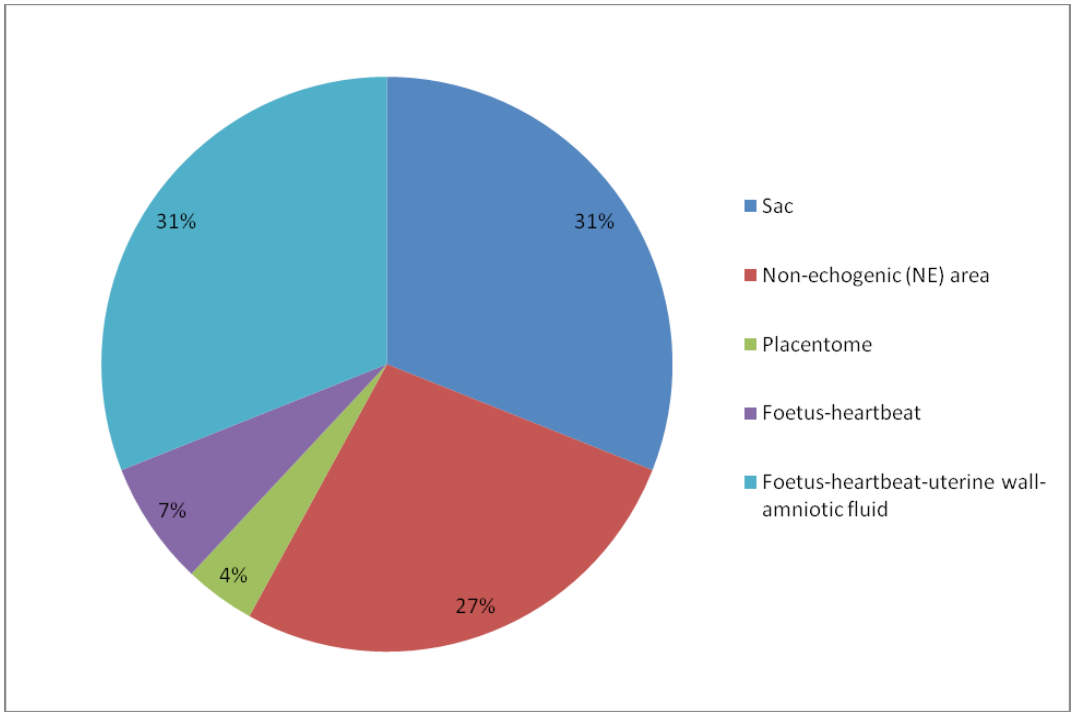


Figure 4.27**:** Pregnancy predictive value (percentage) of each structural image or combination of structures detected using transrectal probe on early stage of gestation for each doe.

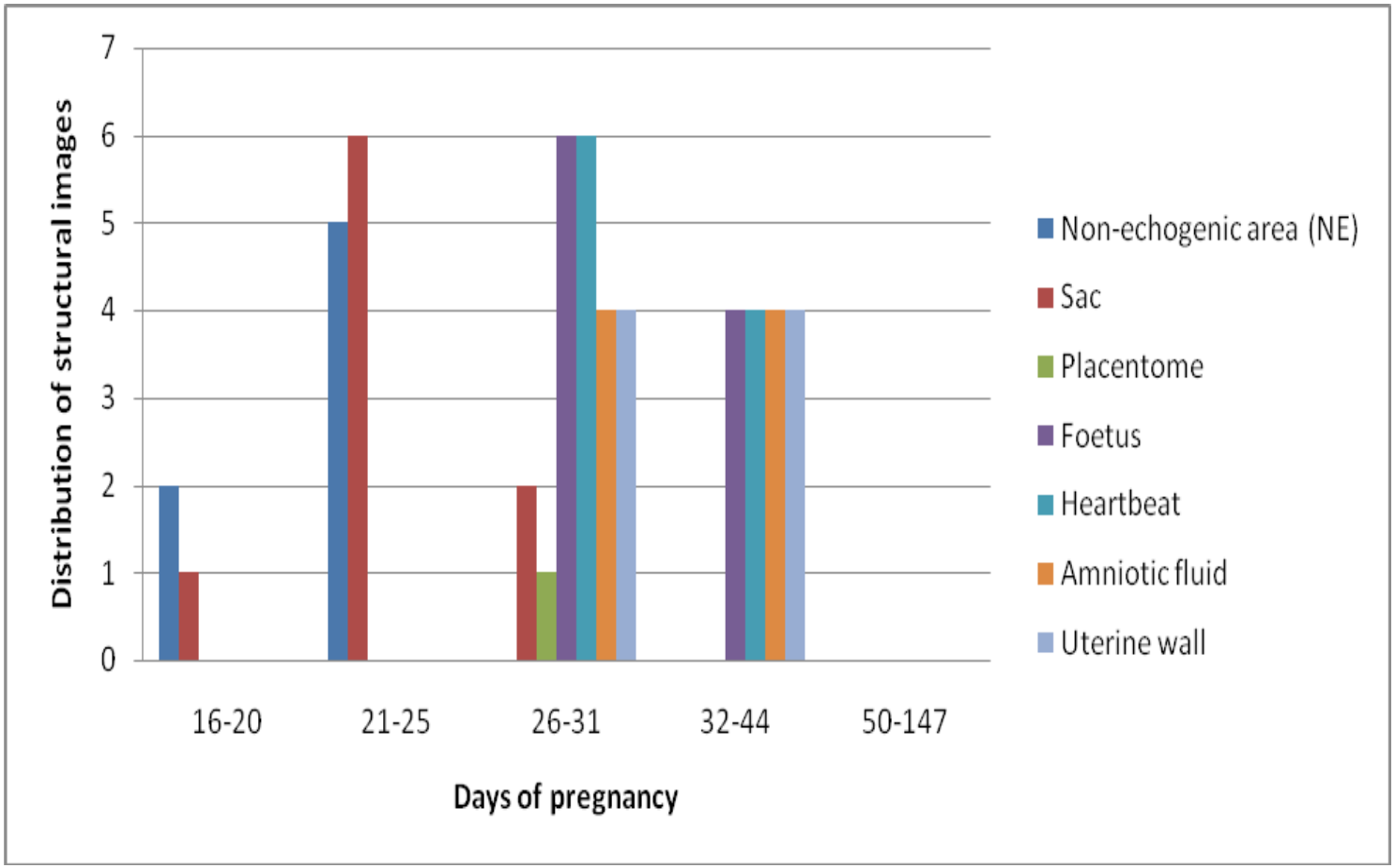


Figure 4.28: Distribution of specific structural images observed for each doe along stage of gestation using transrectal probe calculated based on designated range of days during pregnancy regardless of singular or combination of structures detected for each doe.

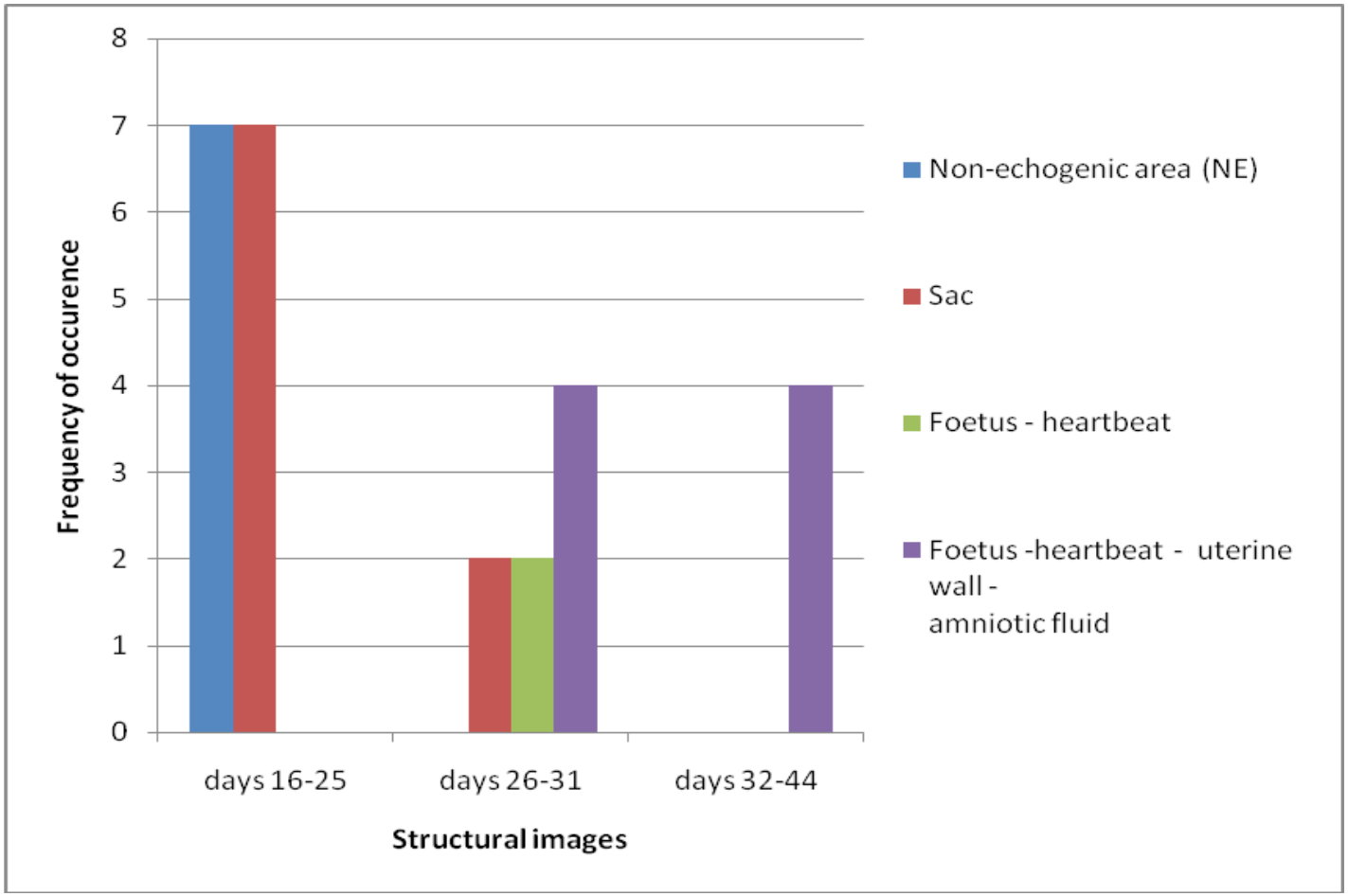


Figure 4.29: Distribution of frequency of selected structural images observed on three period of early pregnancy using transrectal probe

Table 4.5: Number of animals that tested positive and negative with different stage of gestation

	Stage of gestation	
Diagnosis[x]	Initial n=6	Early n=31
a: Correct positive	1	26
b: Incorrect positive	3	0
c: Correct negative	2	4
d: Incorrect negative	0	1
e: Sensitivity (%)	100% (1/1)	96% (26/27)
f: Specificity (%)	40% (2/5)	100% (4/4)
g: Positive predictive value (%)	25% (1/4)	100% (26/26)
h: Negative predictive value (%)	100% (2/2)	80% (4/5)
Overall accuracy (%)	66%	94%

Note:

a: Pregnant does that were correctly diagnosed
b: Pregnant does that were incorrectly diagnosed
c: Non-pregnant does that were correctly diagnosed
d: Non-pregnant does that were incorrectly diagnosed
e: Sensitivity [a/(a + d)]
f: Specificity [c/(b + c)]
g: Positive predictive value [a/(a + b)]
h: Negative predictive value [c/(c + d)]
i : Overall accuracy (e + f + g + h /4)

[x] refers to the confirmation of does whether kidding or not kidding

4.4 OPTIMIZATION OF PREGNANCY DIAGNOSIS OF DOES WITH TRANSABDOMINAL PROBE (EXPERIMENT 4)

Using transabdominal probe, the first indicator detected was placentomes on day 54 of gestation onwards. Combinations of structures, i.e. placentomes-foetus-heartbeat-spinal cord were detected as early as day 56 of gestation (Figures 4.32-4.35). Images of foetus-heartbeat were detected on day 67 of gestation (Figure 4.36). In Figures 4.37-4.39, foetus-heartbeat-placentomes-spinal cord images were detected on days 68 and 72 of gestation. Images of foetus-heartbeat-spinal cord were observed along the middle stage of pregnancy, i.e. on days 56 to 83 of pregnancy. In late stage, foetus-heartbeat-spinal cord-ribs-placentomes were detected from days 84 to 88 of gestation (Figures 4.40-4.43). Images with foetus-heartbeat-spinal cord-foetal organs were detected on days 103 to 119 (Figures 4.44-4.48). During final stage of gestation, placentomes was detected from days 120 to 146 of gestation (Figure 4.49). There was no indicator or structure observed in earlier pregnancy, i.e. on days 25 until 46 of gestation (Figure 4.50). Table 4.6 shows pregnancy indicators according to stages and days of pregnancy. Table 4.7 shows observation of structures using transabdominal probe for middle stage of gestation. Frequency of occurrence of each structure in middle stage, i.e. placentomes; foetus-heartbeat, placentomes-foetus-heartbeat and foetus-heartbeat-spinal cord and/or ribs were 4, 7, 5 and 5 times, respectively. Predictive values for placentomes, foetus-heartbeat, placentomes-foetus-heartbeat and foetus-heartbeat-spinal cord and/or ribs during middle stage were 19%, 33%, 24% and 24% (Figure 4.51). During late stage, occurrence of each structures and combinations i.e. placentomes, foetus-heartbeat, foetus-heartbeat-spinal cord-ribs, placentomes-foetus-heartbeat-spinal cord-ribs, foetus-heartbeat-spinal cord-ribs-foetal organ and placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ were twice, thrice, thrice, 5, 7 and 8 times, respectively (Table 4.8). Figure 4.52 shows pregnancy predictive

for placentomes, foetus-heartbeat, foetus-heartbeat-spinal cord and/or ribs, placentomes-foetus-heartbeat-spinal cord and/or ribs, foetus-heartbeat-spinal cord and/or ribs-foetal organ and placentomes-foetus-heartbeat-spinal cord and/or ribs-foetal organ were 7, 10, 10, 19, 25 and 29%. In final stage (Table 4.9), placentomes and placentomes-foetus-heartbeat-spinal cord and/or ribs-foetal organ gave seven and once, respectively. Predictive values for placentomes and placentomes-foetus-heartbeat-spinal cord and/or ribs-foetal organ were 87.5 and 12.5%, respectively (Figure 4.53). Predictive value (percent) for each stages were summarized in Figure 4.54. Summary on frequency of singular and combination of structural images and were observed along gestation period in Figure 4.55. Number of does diagnosed with sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy along gestation period are shown in Table 4.10. All animals were positively diagnosed and obtained 100% accuracy during initial, early, late and final stage of gestation. During middle stage of gestation, one doe was negatively diagnosed as pregnant and non-pregnant, respectively. Percentage of sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy for middle stage is 95.5, 92 and 93.75, 97 and 98%, respectively.

Table 4.6: Images on indicators along pregnancy gestation using 5.0 MHz using transabdominal probe

Stage of pregnancy	N	Days	Indicator	Placentome	Foetus	Amniotic fluid	Heartbeat	Spinal cord	Ribs	Foetal organ
Initial (days 1-21)	2*	13	-(2)	-	-	-	-	-	-	-
	2*	14	-(2)	-	-	-	-	-	-	-
	2*	15	-(2)	-	-	-	-	-	-	-
	2*	16	-(2)	-	-	-	-	-	-	-
	2*	18	-(2)	-	-	-	-	-	-	-
	4*	19	-(4)	-	-	-	-	-	-	-
Early (days 22-49)	4*	25	-(4)	-	-	-	-	-	-	-
	4*	26	-(4)	-	-	-	-	-	-	-
	4*	27	-(4)	-	-	-	-	-	-	-
	3*	28	-(3)	-	-	-	-	-	-	-
	3*	29	-(3)	-	-	-	-	-	-	-
	2*	30	-(2)	-	-	-	-	-	-	-
	2*	31	-(2)	-	-	-	-	-	-	-
	3*	32	-(3)	-	-	-	-	-	-	-
	3*	33	-(3)	-	-	-	-	-	-	-
	2*	35	-(2)	-	-	-	-	-	-	-
	2*	36	-(2)	-	-	-	-	-	-	-
	2*	37	-(2)	-	-	-	-	-	-	-
	2*	38	-(2)	-	-	-	-	-	-	-
	2*	40	-(2)	-	-	-	-	-	-	-
	2*	41	-(2)	-	-	-	-	-	-	-
	2*	42	-(2)	-	-	-	-	-	-	-
	2*	44	-(2)	-	-	-	-	-	-	-
Middle (days 50-83)	1	50	+	+	-	-	-	-	-	-
	1	56	+	+	+	+	+	+	-	-
	1	58	+	+	+	+	+	+	-	-
	1	60	+	+	+	+	+	+	-	-

(continued)

(continued)

Stage	N	Days	Indicator	Placentome	Foetus	Amniotic fluid	Heartbeat	Spinal cord	Ribs	Foetal organ
Middle (days 50-83)	2*	61	+	+ (a)	+ (a,b)	+ (b)	+ (a,b)	-	-	-
	2*	63	+	+ (b)	+ (a,b)	-	+ (a,b)	+ (a)	+ (a)	-
	3*	66	+	+ (a)	+ (b,c)	+ (b,c)	+ (b,c)	-	-	-
	2*	67	+	+ (b)	+ (a,b)	-	+ (a,b)	+ (a)	+ (a)	-
	2*	68	+	-	+ (a,b)	+ (a)	+ (a,b)	+ (b)	+ (b)	-
	2*	72	+	+ (a,b)	+ (a,b)	-	+ (a,b)	-	-	-
	1	73	+	-	+	+	+	-	-	-
	1	74	+	-	+	+	+	-	-	-
	2*	76	+	+ (a)	+ (b)	+ (b)	+ (b)	-	-	-
	3*	83	+	+ (a,b,c)	+ (b,c)	-	+ (b,c)	+ (b,c)	+ (b,c)	-
Late (days 84-119)	1	84	+	+	+	-	+	+	+	-
	2*	87	+	+ (b)	+ (a)	-	+ (a)	+ (a)	+ (a)	-
	1	88	+	-	+	-	+	-	-	-
	2*	92	+	+ (b)	+ (a,b)	+ (a,b)	+ (a,b)	+ (a,b)	+ (b)	-
	1	93	+	-	+	+	+	+	+	-
	1	94	+	+	+	-	+	+	+	-
	2*	95	+	+ (a)	+ (a,b)	-	+ (a,b)	+ (a,b)	+ (a,b)	+ (a,b)

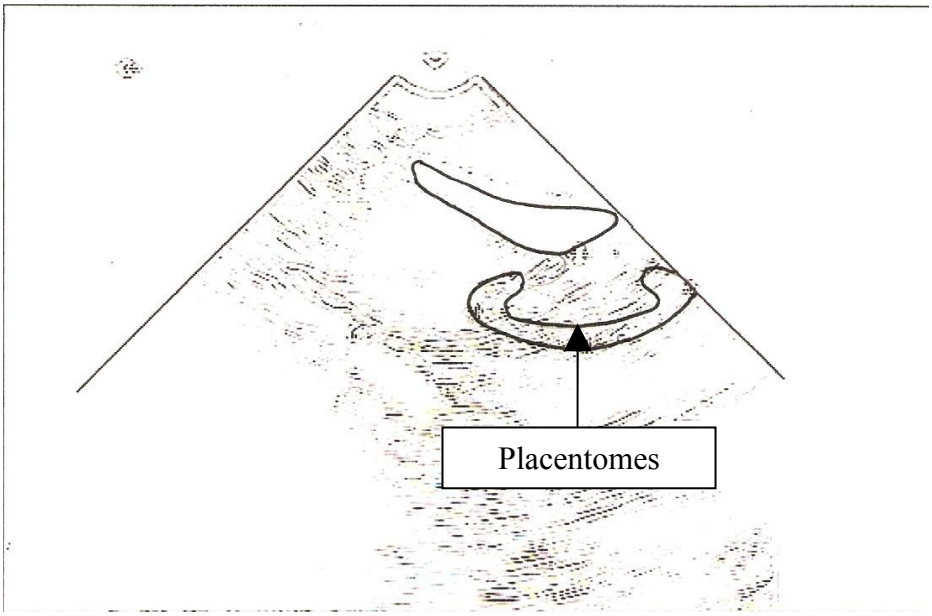
(continued)

(continued)

Stage	N	Days	Indicator	Placentome	Foetus	Amniotic fluid	Heartbeat	Spinal cord	Ribs	Foetal organ
Late (days 84-119)	1	96	+	+	+	-	+	+	+	+
	2*	97	+	+ (a)	+ (a,b)	-	+ (a,b)	+ (a,b)	+ (a,b)	+ (a,b)
	1	103	+	+	+	-	+	+	+	+
	1	105	+	+	+	-	+	+	+	+
	1	106	+	+	+	-	+	+	+	+
	3*	110	+	+ (a)	+ (a,b,c)	-	+ (a,b,c)	+ (a,b,c)	+ (a,b,c)	+ (a,b,c)
	1	112	+	+	+	-	+	+	+	+
	2*	113	+	+ (a)	+ (a,b)	-	+ (a,b)	+ (a,b)	+ (a,b)	+ (a,b)
	1	114	+	-	+	-	+	+	+	+
	2*	116	+	+ (b)	+ (a,b)	-	+ (a,b)	+ (a,b)	+ (a,b)	+ (a,b)
	2*	117	+	+ (a)	+ (b)	-	+ (b)	+ (b)	+ (b)	+ (b)
	1	119	+	-	+	-	+	-	-	-
Final (days 120-147)	1	120	+	+	-	-	-	-	-	-
	2*	121	+	+ (a,b)	-	-	-	-	-	-
	1	124	+	+	-	-	-	-	-	-
	1	127	+	+	-	-	-	-	-	-
	2*	130	+	+ (a,b)	+ (b)	-	+ (b)	+ (b)	+ (b)	+ (b)
	1	146	+	+	-	-	-	-	-	-
Total	118									

* Observation was based on individual does on same days of gestation (assumption 147 days of gestation length)

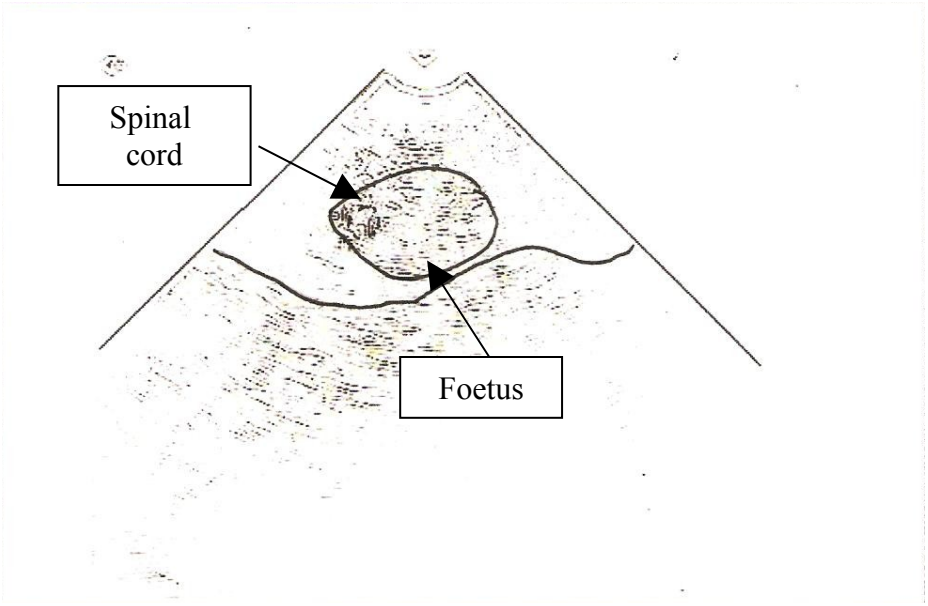
(A)



(B)

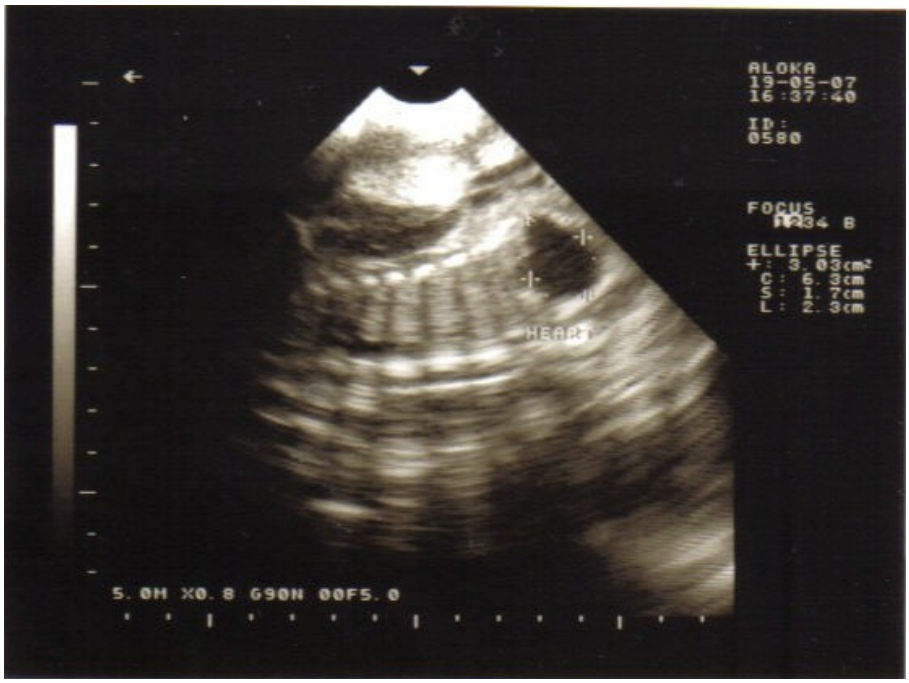
Figure 4.30 Image (A) is an original image. Placentomes were detected on day 56 of gestation (middle stage). Image (B) is a labeled image.

(A)

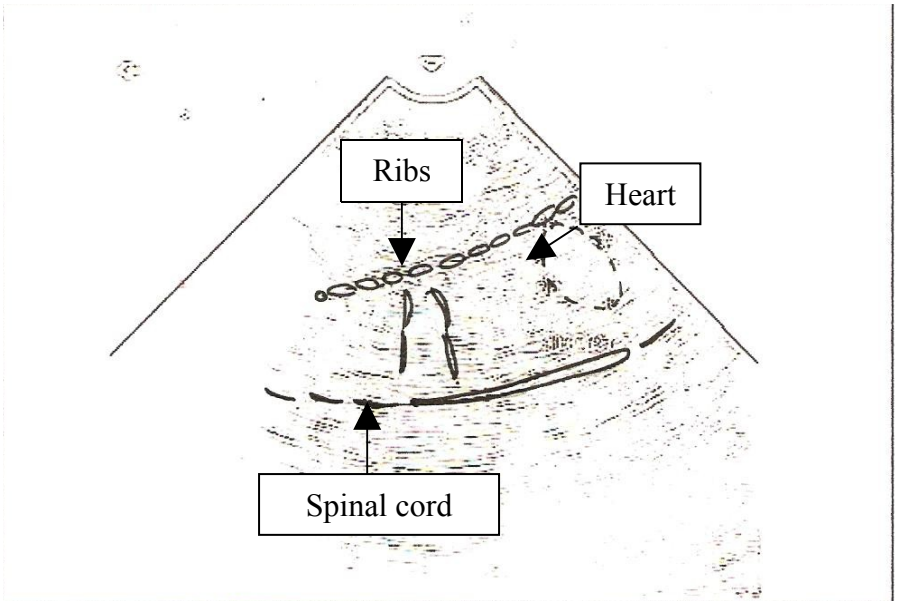


(B)

Figure 4.31: Image (A) is an original image. Foetus with heartbeat and spinal cord were detected on day 56 of gestation (middle stage). Image (B) is a labeled image.



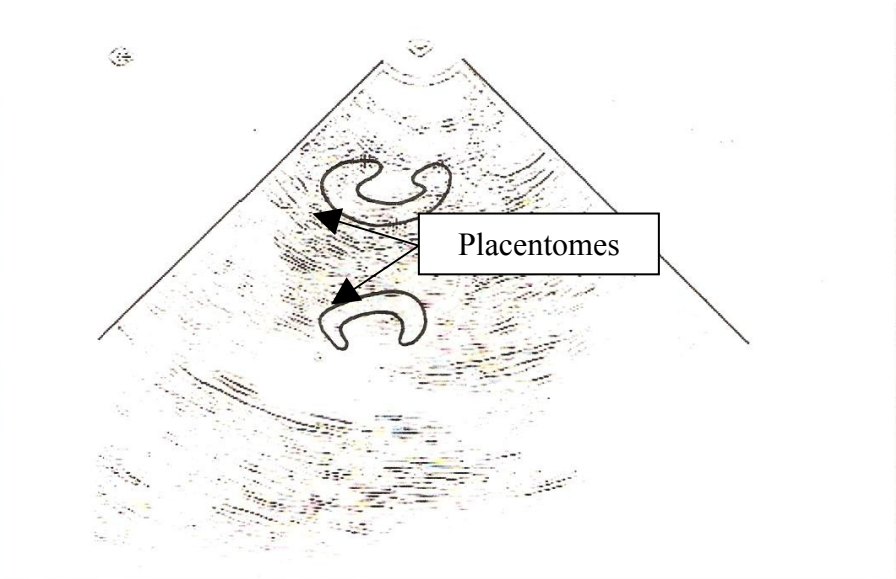
(A)



(B)

Figure 4.32: Image (A) is an original image. Foetus with heartbeat and spinal cord were detected on day 63 of gestation (middle stage). Image (B) is a labeled image.

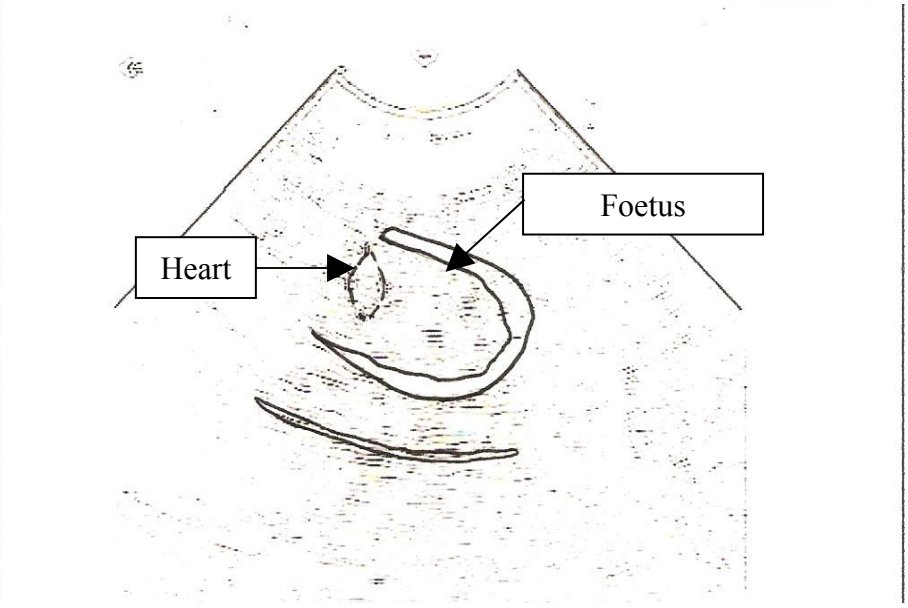
(A)



(B)

Figure 4.33: Image (A) is an original image. Placentomes were detected on day 63 of gestation (middle stage). Image (B) is a labeled image.

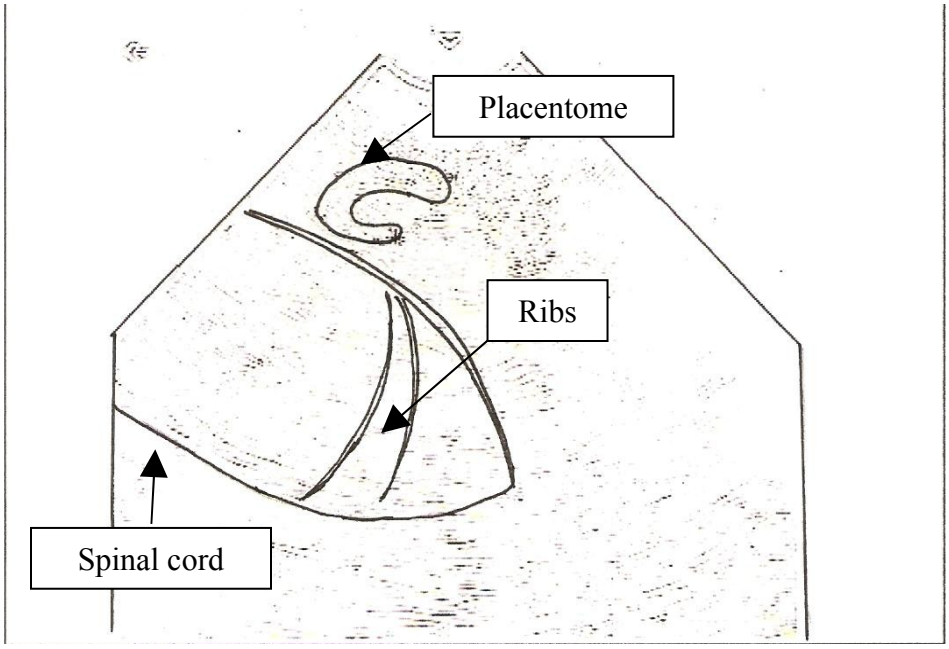
(A)



(B)

Figure 4.34: Image (A) is an original image. Foetus with heartbeat was detected on day 67 of gestation (middle stage). Image (B) is a labeled image.

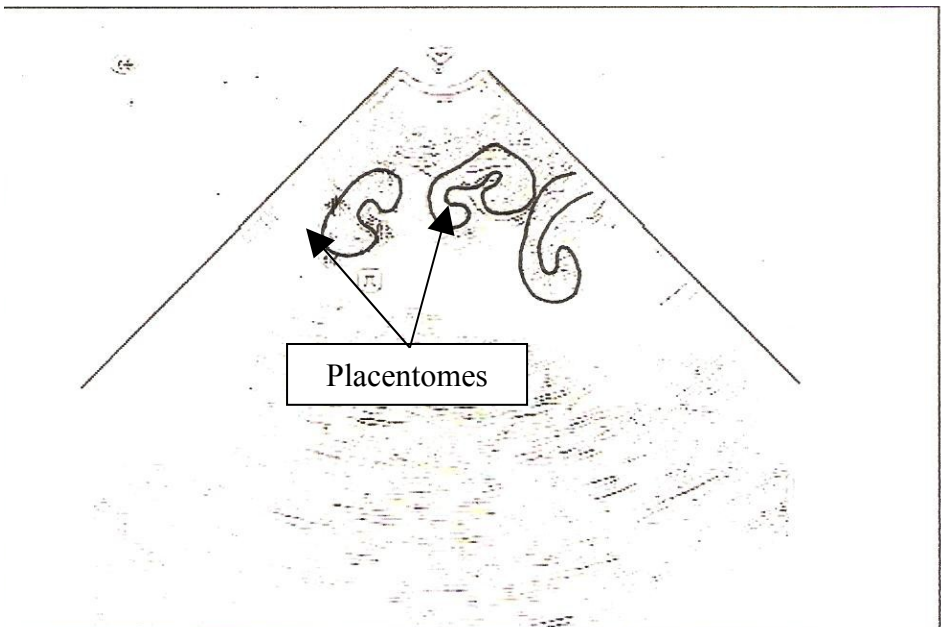
(A)



(B)

Figure 4.35: Image (A) is an original image. Placentomes, ribs, and spinal cord was detected on day 68 of gestation (middle stage). Image (B) is a labeled image.

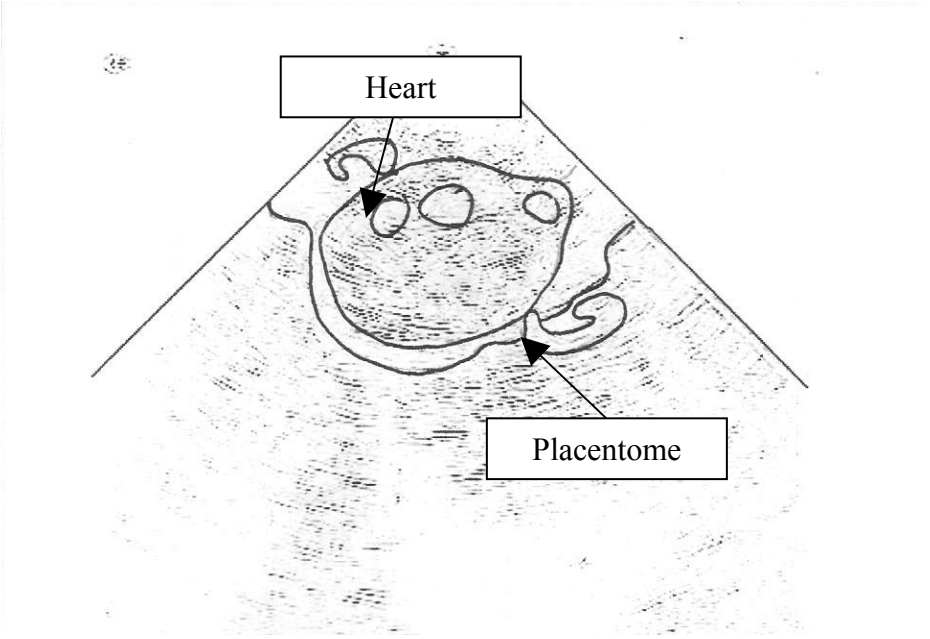
(A)



(B)

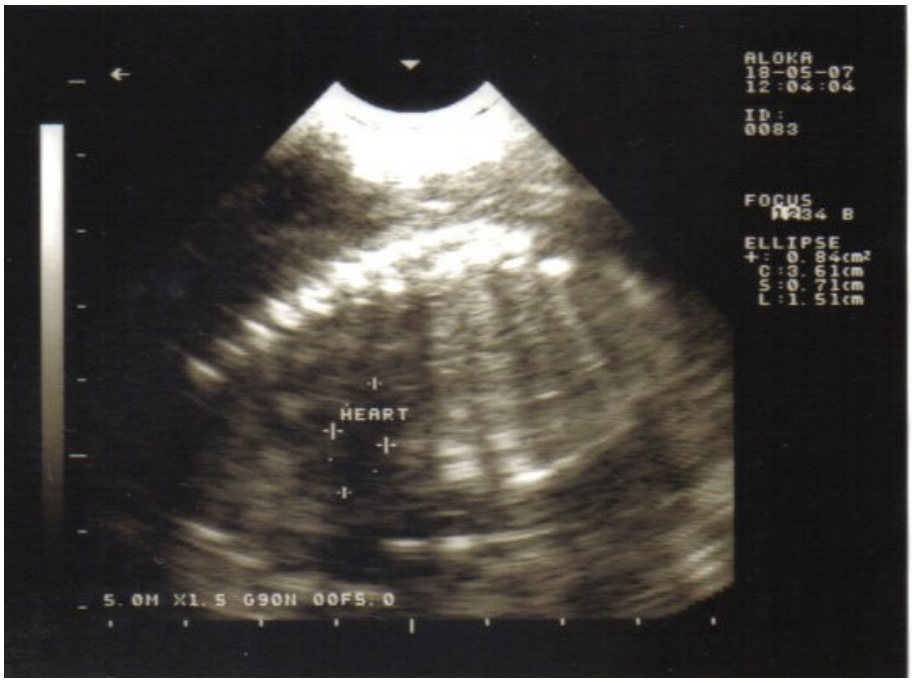
Figure 4.36: Image (A) is an original image. Placentomes were detected on day 72 of gestation (middle stage). Image (B) is a labeled image.

(A)

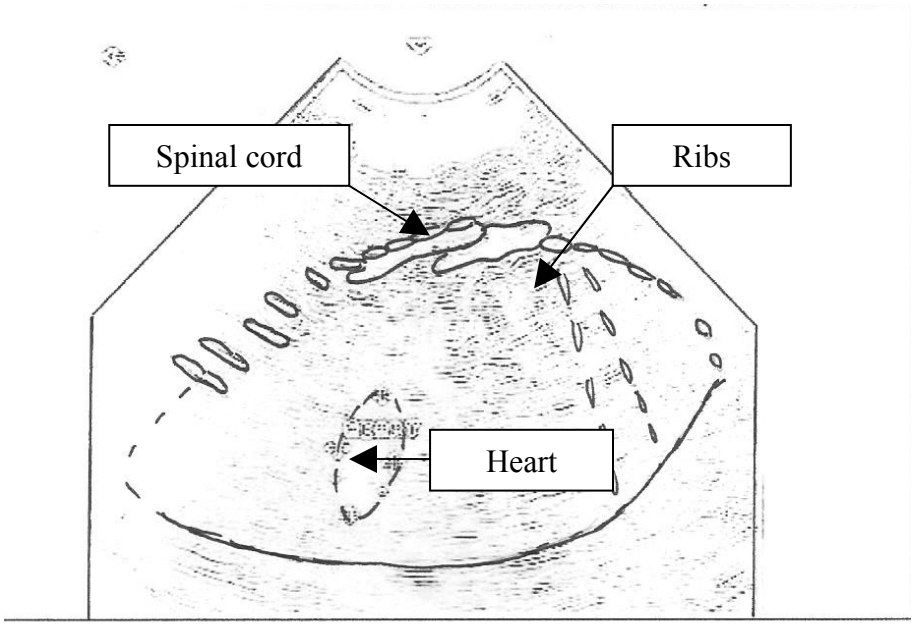


(B)

Figure 4.37: Image (A) is an original image. Foetus with heartbeat surrounded by placentomes were detected on day 72 of gestation (middle stage). Image (B) is a labeled image.



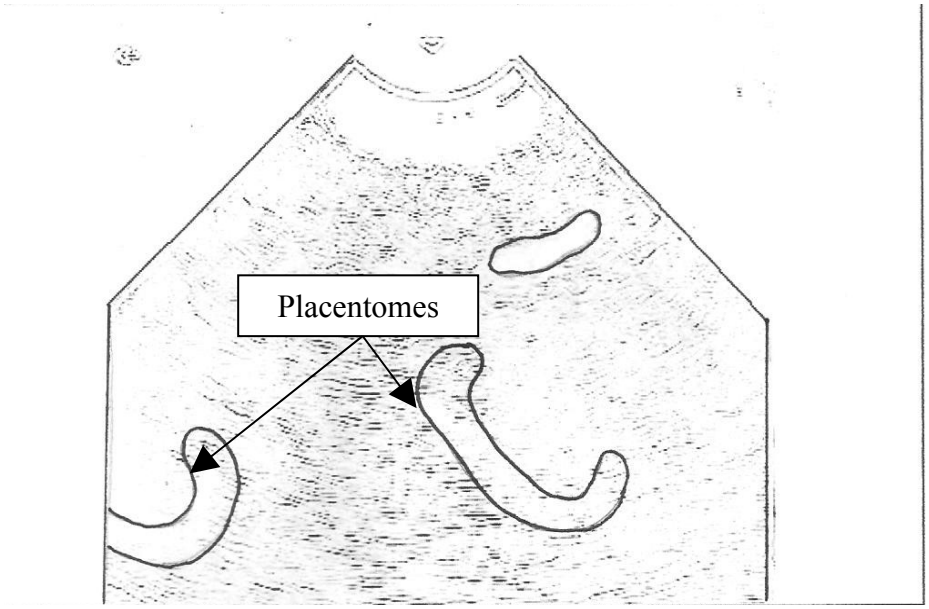
(A)



(B)

Figure 4.38: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs were detected on day 84 of gestation (late stage). Image (B) is a labeled image.

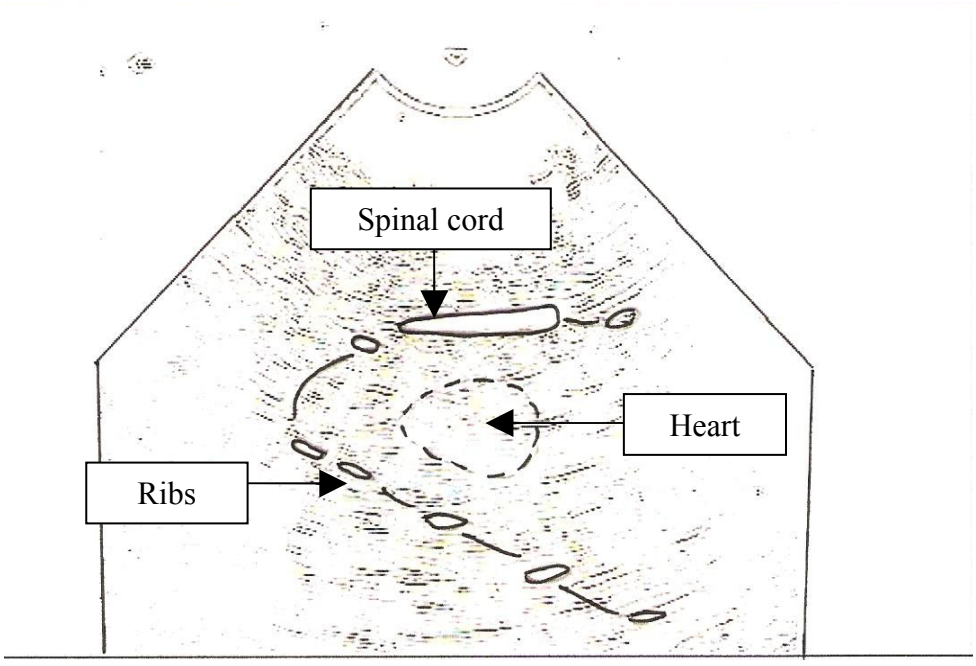
(A)



(B)

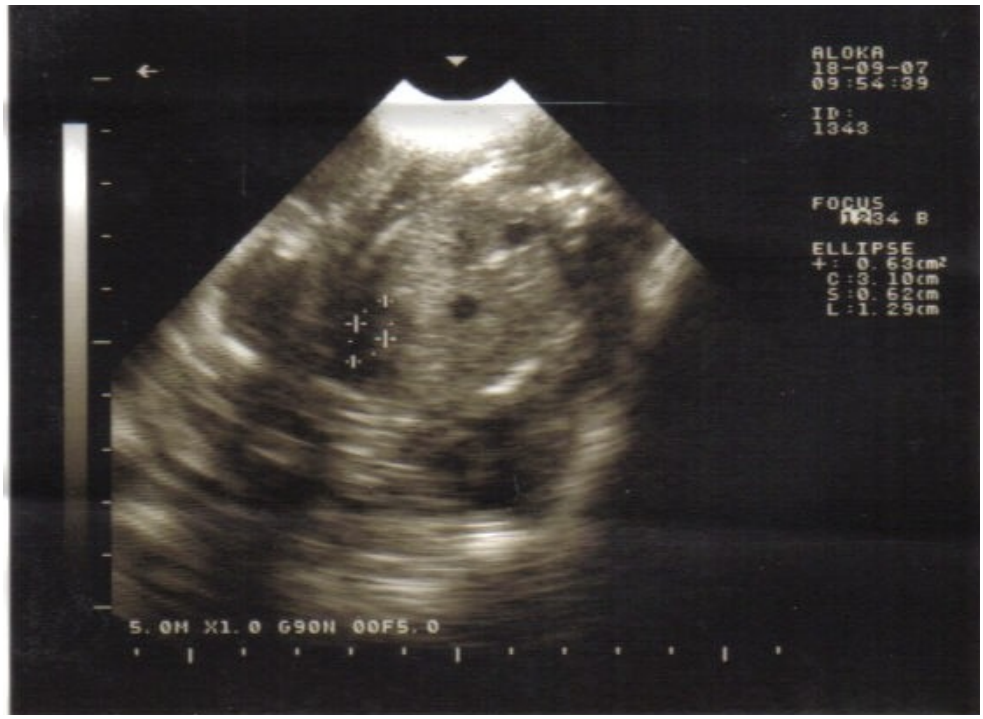
Figure 4.39: Image (A) is an original image. Placentomes were detected on day 84 of gestation (late stage). Image (B) is a labeled image.

(A)

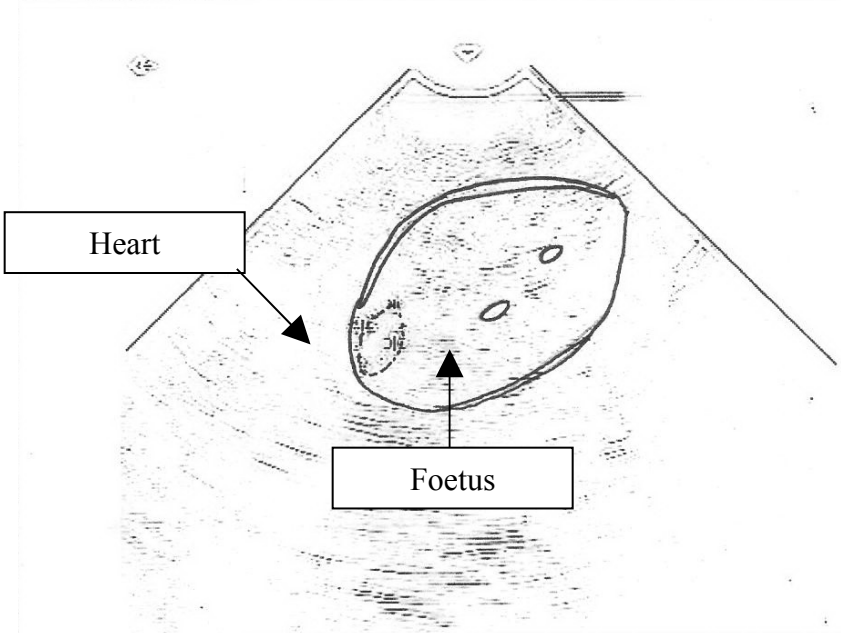


(B)

Figure 4.40: Image (A) is an original image. Foetus with spinal cord, ribs and foetal organs were detected on day 87 of gestation (late stage). Image (B) is a labeled image.

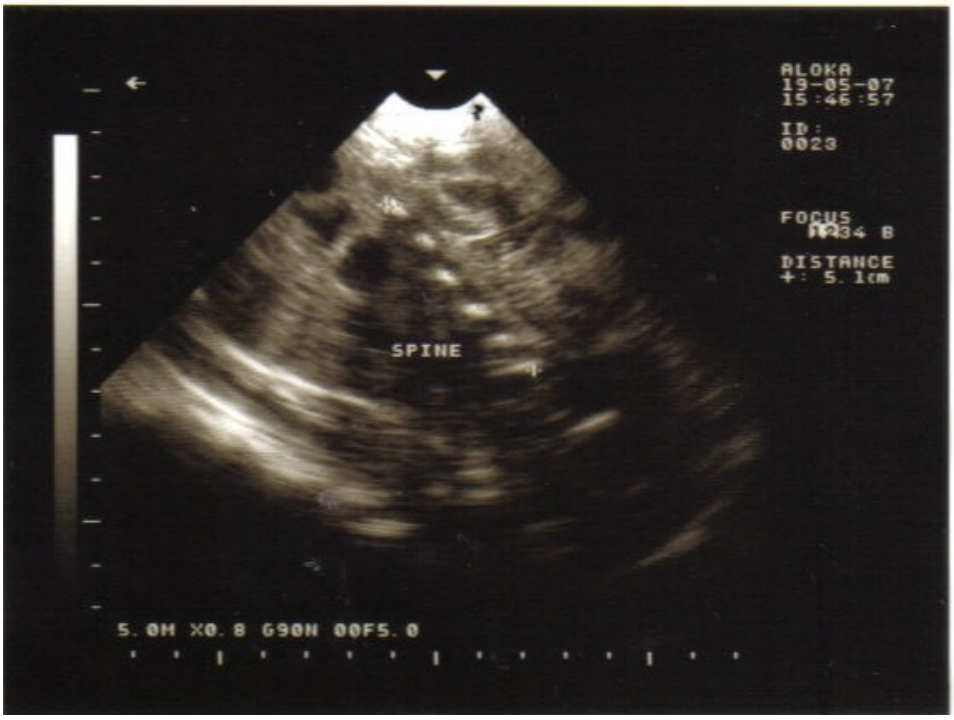


(A)

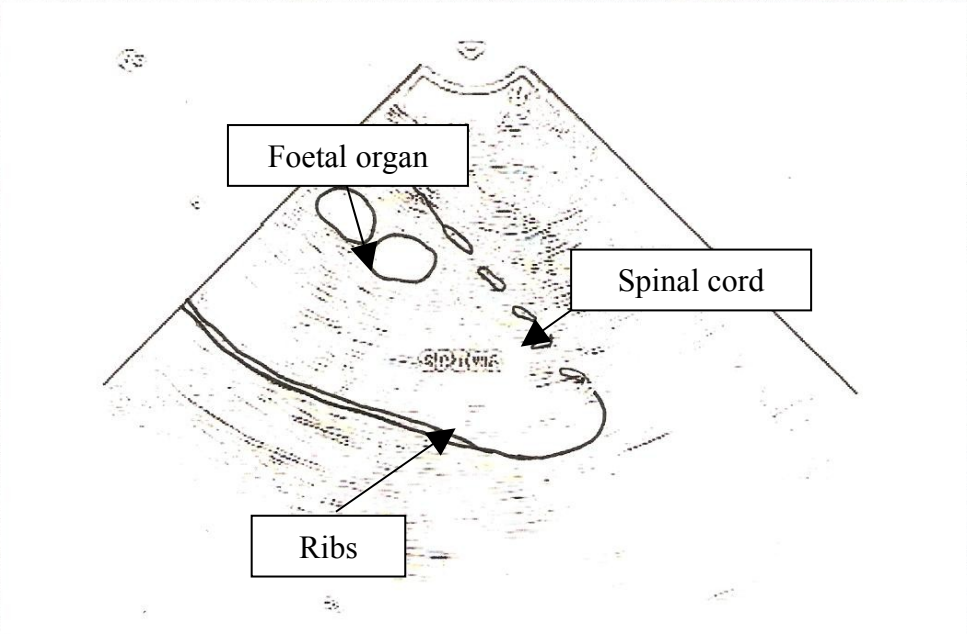


(B)

Figure 4.41: Image (A) is an original image. Foetus with heartbeat was detected on day 88 of gestation (late stage). Image (B) is a labeled image.

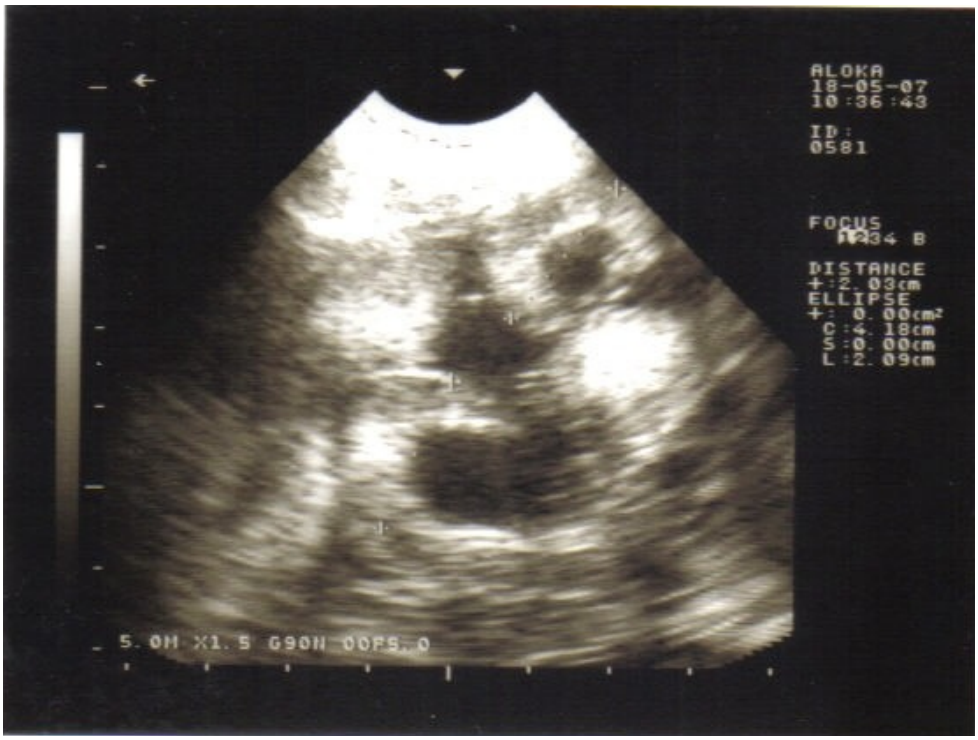


(A)

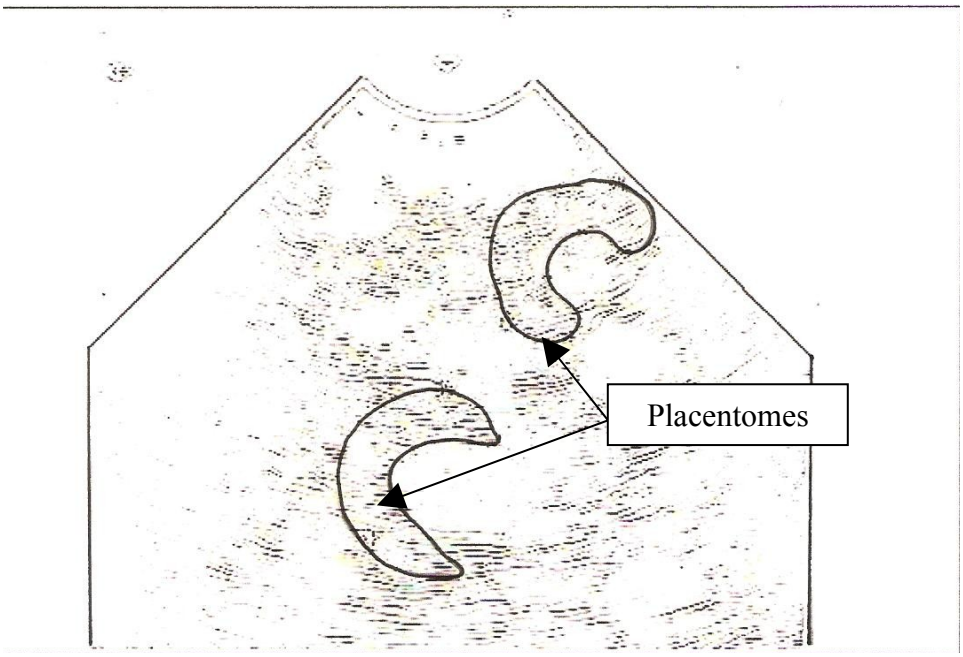


(B)

Figure 4.42: Image (A) is an original image. Foetus with spinal cord, ribs and foetal organs were detected on day 103 of gestation (late stage). Image (B) is a labeled image.

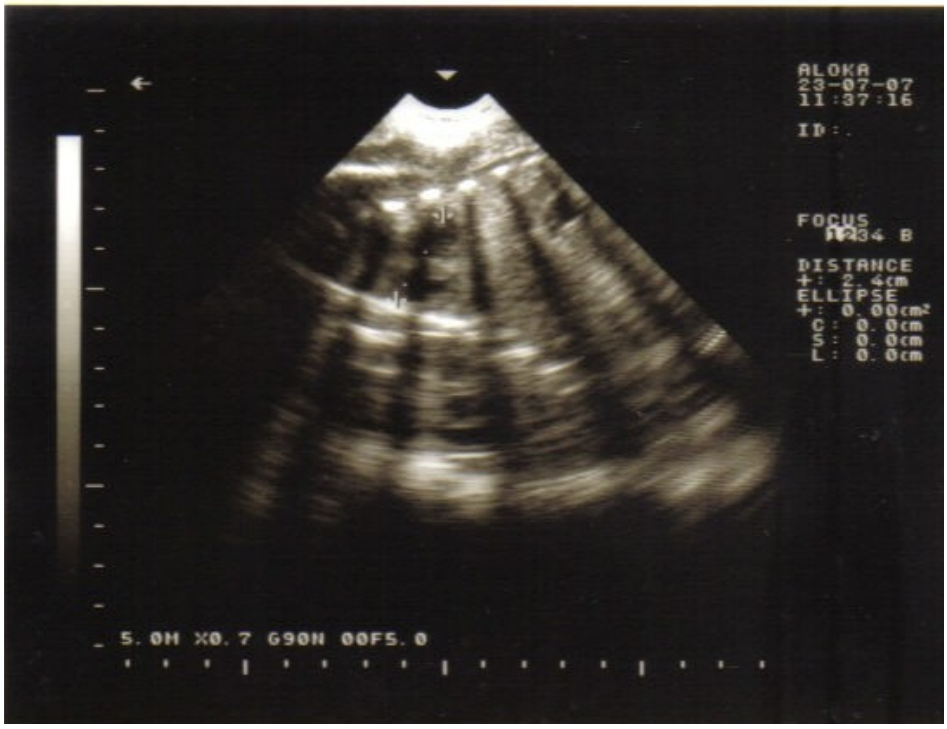


(A)

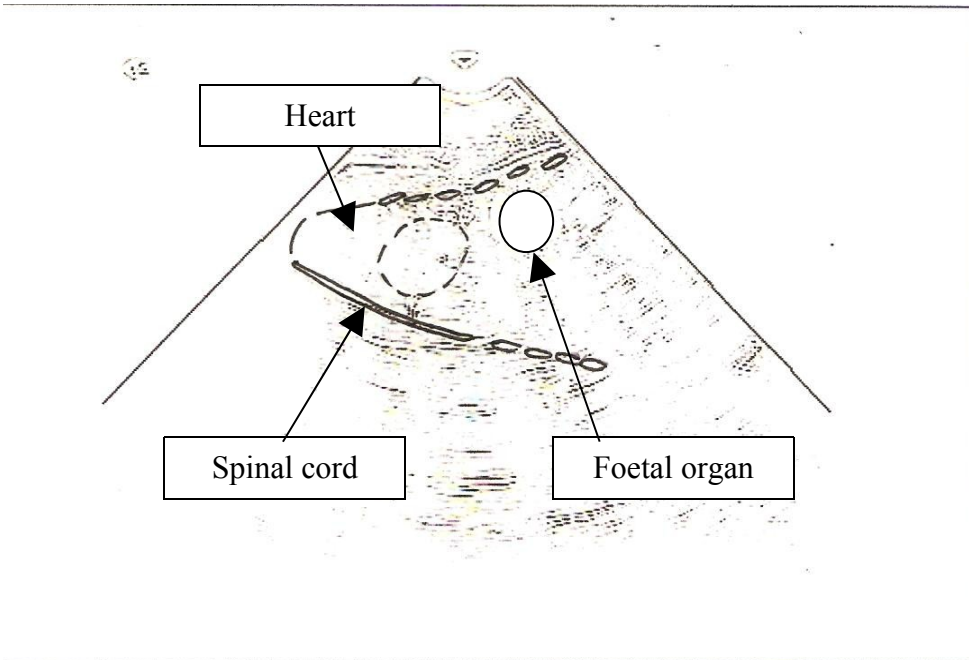


(B)

Figure 4.43: Image (A) is an original image. Placentomes were detected on day 105 of gestation (late stage). Image (B) is a labeled image.

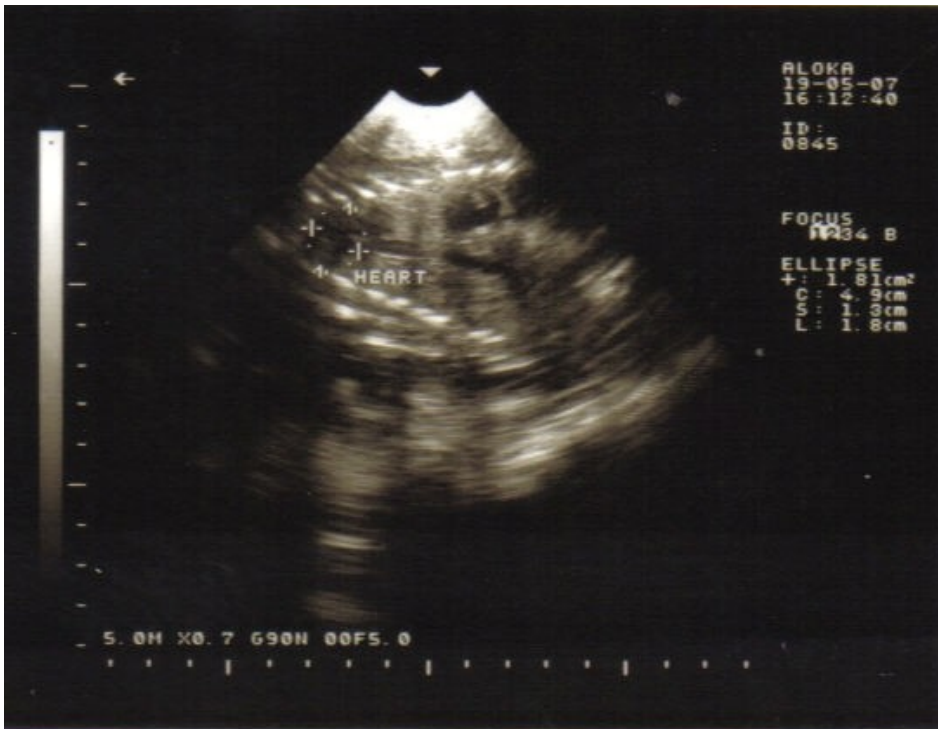


(A)

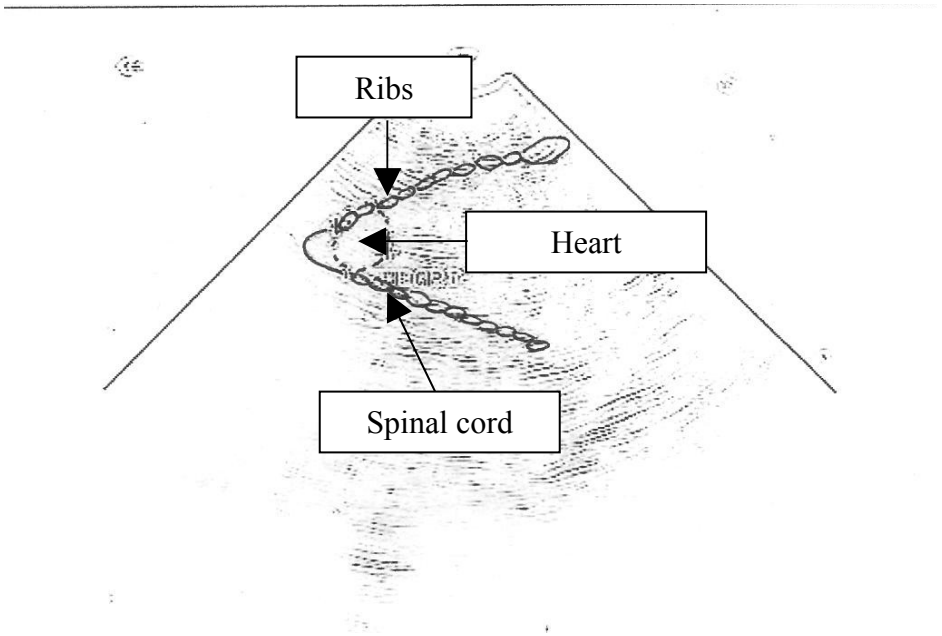


(B)

Figure 4.44: Image (A) is an original image. Foetus with heartbeat, spinal cord and foetal organs were detected on day 106 of gestation (late stage). Image (B) is a labeled image.

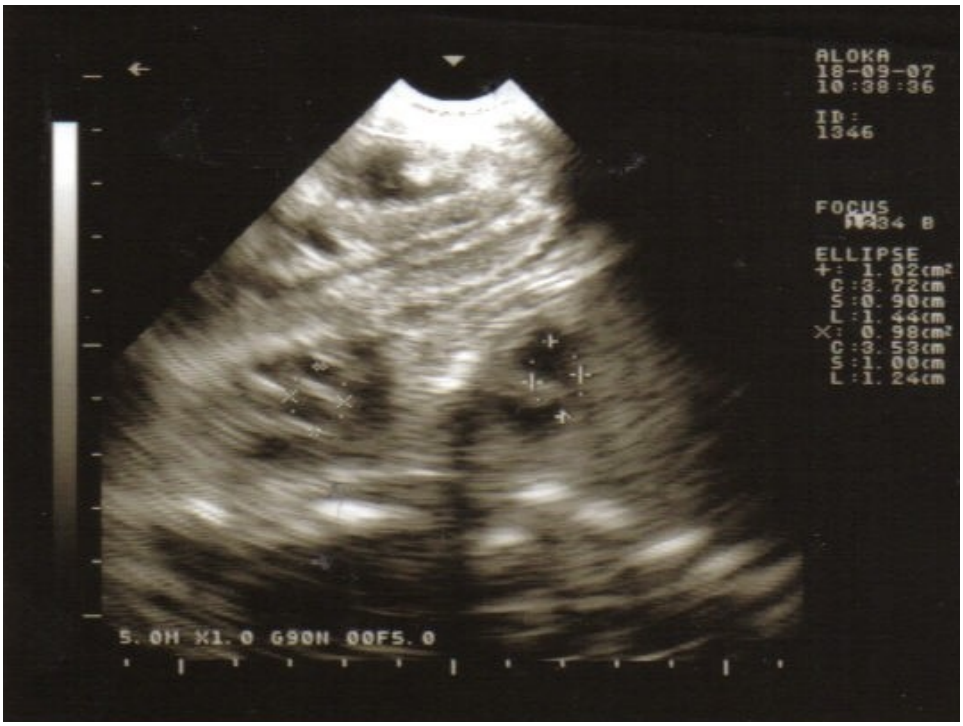


(A)

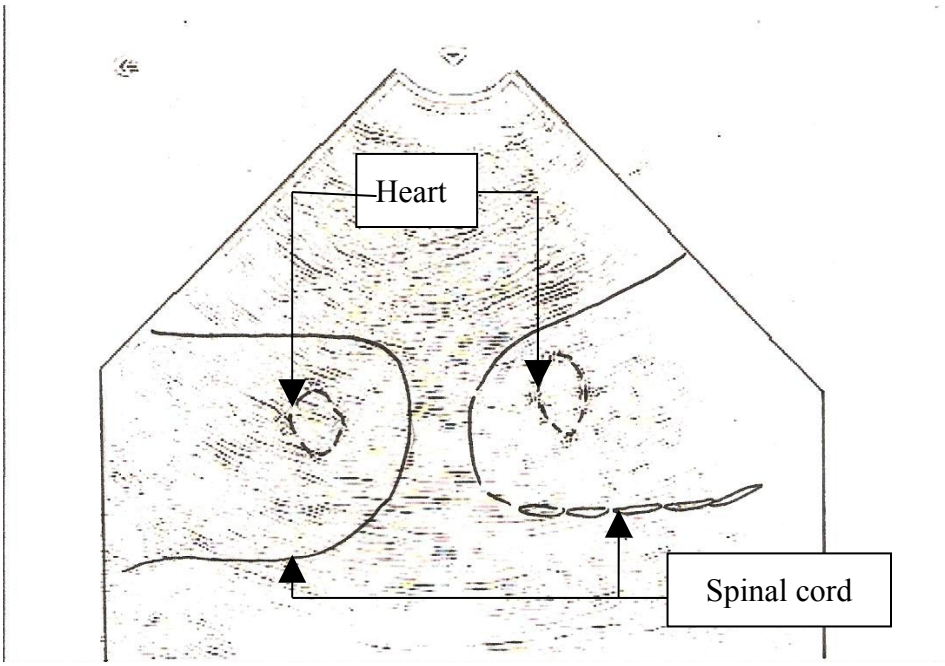


(B)

Figure 4.45: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs were detected on day 110 of gestation (late stage). Image (B) is a labeled image.

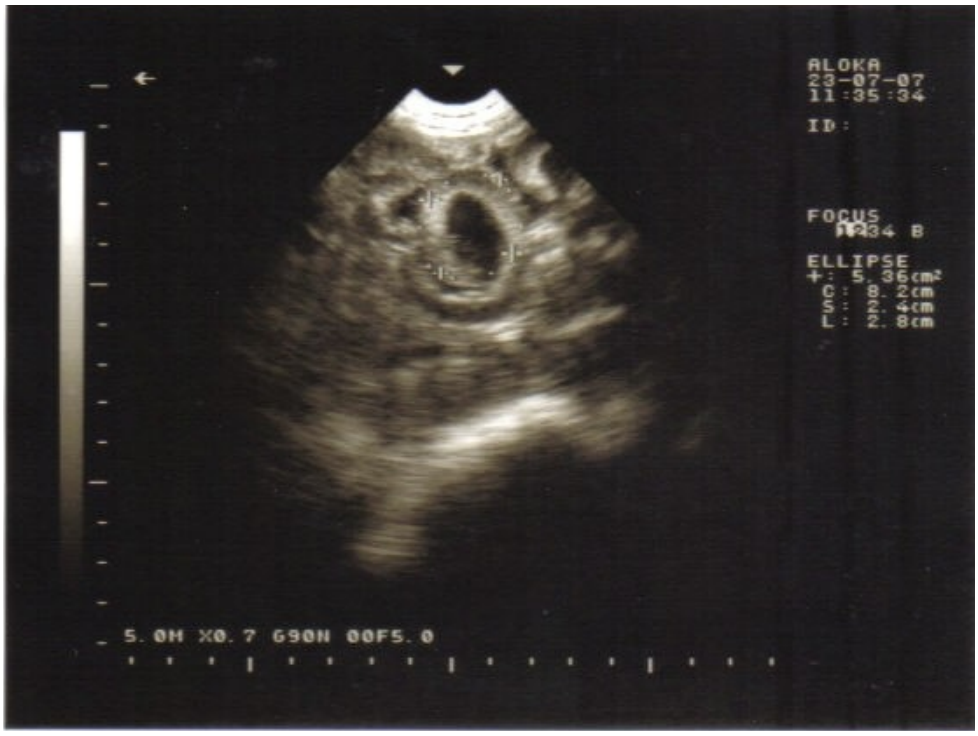


(A)

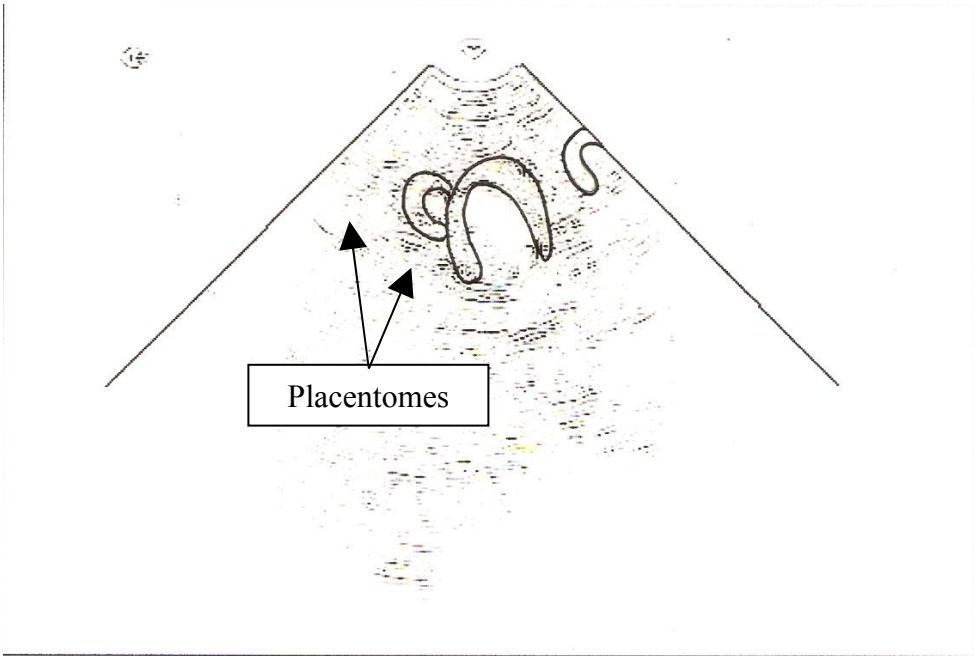


(B)

Figure 4.46: Image (A) is an original image. Heart and spinal cord were detected on day 117 of gestation (late stage). Image (B) is a labeled image.

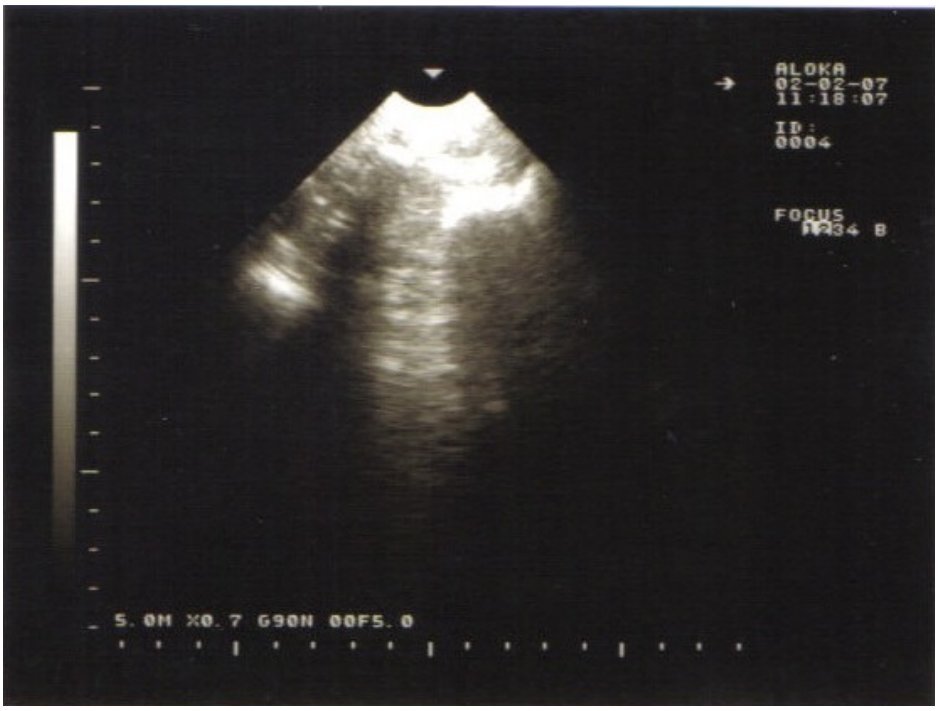


(A)

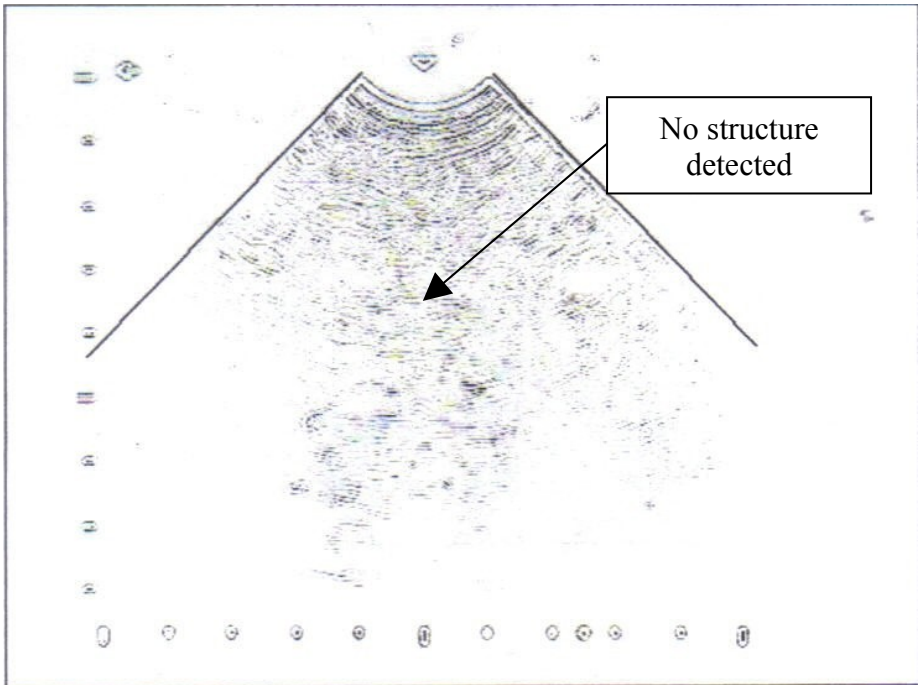


(B)

Figure 4.47: Image (A) is an original image. Placentomes were detected on day 121 of gestation (final stage). Image (B) is a labeled image.



(A)



(B)

Figure 4.48: Image (A) is an original image. No indicator was detected on day 35 of gestation (early stage). Image (B) is a labeled image.

Table 4.7: Image observation for each structure/combinations of structures using transabdominal probe during early and middle stages of gestation

N	Days	Placentome	Foetus	Heartbeat	Spinal cord	Ribs	Foetal organ	Foetus-heartbeat	Placentome-foetus-heartbeat	Foetus-heartbeat-spinal cord/ ribs	Placentome -foetus-heartbeat - spinal cord /ribs	Foetus-heartbeat -spinal cord-ribs-foetal organ	Placentome-foetus-heartbeat -spinal cord-ribs-foetal organ
58	13-59	-	-	-	-	-	-	-	-	-	-	-	-
1	50	+	-	-	-	-	-	-	-	-	-	-	-
1	56	-	-	-	-	-	-	-	-	-	+	-	-
1	58	-	-	-	-	-	-	-	-	-	+	-	-
1	60	-	-	-	-	-	-	-	-	-	+	-	-
2*	61	-	-	-	-	-	-	+	+	-	-	-	-
2*	63	-	-	-	-	-	-	-	+	+	-	-	-
3*	66	+	-	-	-	-	-	+ (2)	-	-	-	-	-
2*	67	-	-	-	-	-	-	-	+	+	-	-	-
2*	68	-	-	-	-	-	-	+	-	+	-	-	-
2*	72	-	-	-	-	-	-	-	+ (2)	-	-	-	-
1	73	-	-	-	-	-	-	+	-	-	-	-	-
1	74	-	-	-	-	-		+	-	-	-	-	-
2*	76	+	-	-	-	-	-	+	-	-	-	-	-
3*	83	+	-	-	-	-	-	-	-	+ (2)	-	-	-
24		4	0	0	0	0	0	7	5	5	3	0	0
Predictive value (%)		17	0	0	0	0	0	30	20	20	13	0	0

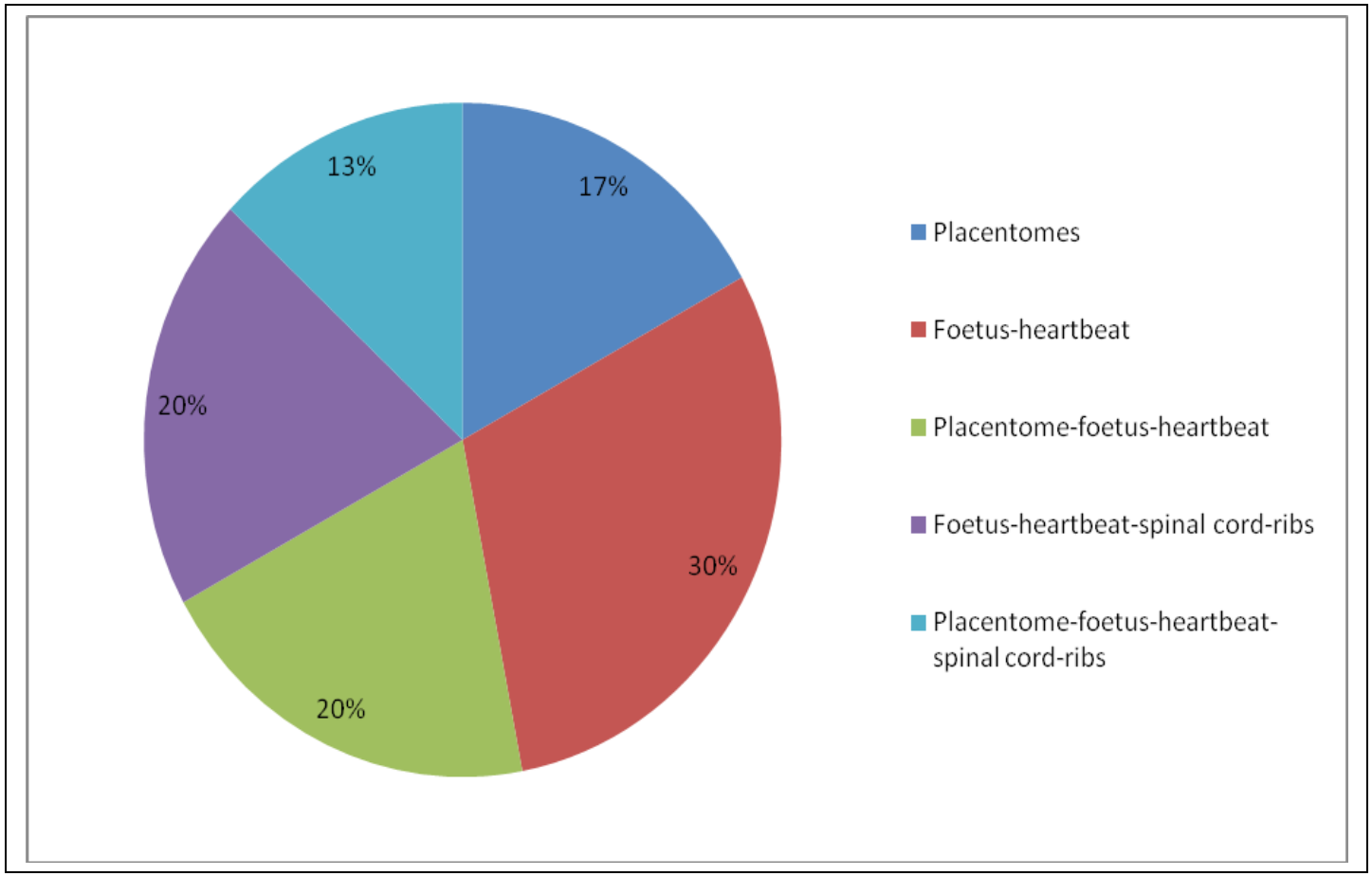


Figure 4.49**:** Pregnancy predictive value (percentage) of each structural image/combination of structures occurrence using transabdominal probe during middle stage of gestation

Table 4.8: Image observation for each structure/combination of structures using transabdominal probe structures during late stage of gestation

N	Days	Placentome	Foetus	Heartbeat	Spinal cord	Ribs	Foetal organ	Foetus-heartbeat	Placentome-foetus-heartbeat	Foetus-heartbeat-spinal cord/ ribs	Placentome -foetus-heartbeat - spinal cord /ribs	Foetus-heartbeat -spinal cord-ribs-foetal organ	Placentome-foetus-heartbeat -spinal cord-ribs- foetal organ
1	84	-	-	-	-	-	-	-	-	-	+	-	-
2*	87	+	-	-	-	-	-	-	-	+	-	-	-
1	88	-	-	-	-	-	-	+	-	-	-	-	-
2*	92	-	-	-	-	-	-	-	-	+	+	-	-
1	93	-	-	-	-	-	-	-	-	+	-	-	-
1	94	-	-	-	-	-	-	-	-	-	+	-	-
2*	95	-	-	-	-	-	-	-	-	-	-	+	+
1	96	-	-	-	-	-	-	-	-	-	-	-	+
2*	97		-	-	-	-	-	-	-	-	-	+	+
1	103	-	-	-	-	-	-	-	-	-	-	-	+
1	105	-	-	-	-	-	-	-	-	-	-	-	+
1	106	-	-	-	-	-	-	-	-	-	-	-	+
3*	110	-	-	-	-	-	-	-	-	-	-	+ (2)	+
1	112	-	-	-	-	-	-	-	-	-	-	-	+
2*	113	-	-	-	-	-	-	-	-	-	-	+	+
1	114	-	-	-	-	-	-	-	-	-	-	+	-
2*	116	-	-	-	-	-	-	-	-	-	-	+	+
2*	117	+	-	-	-	-	-	-	-	-	-	+	-
1	119	-	-	-	-	-	-	+	-	-	-	-	-
28		2	0	0	0	0	0	2	0	3	3	8	10
Predictive value (%)		7	0	0	0	0	0	7	0	11	11	28	36

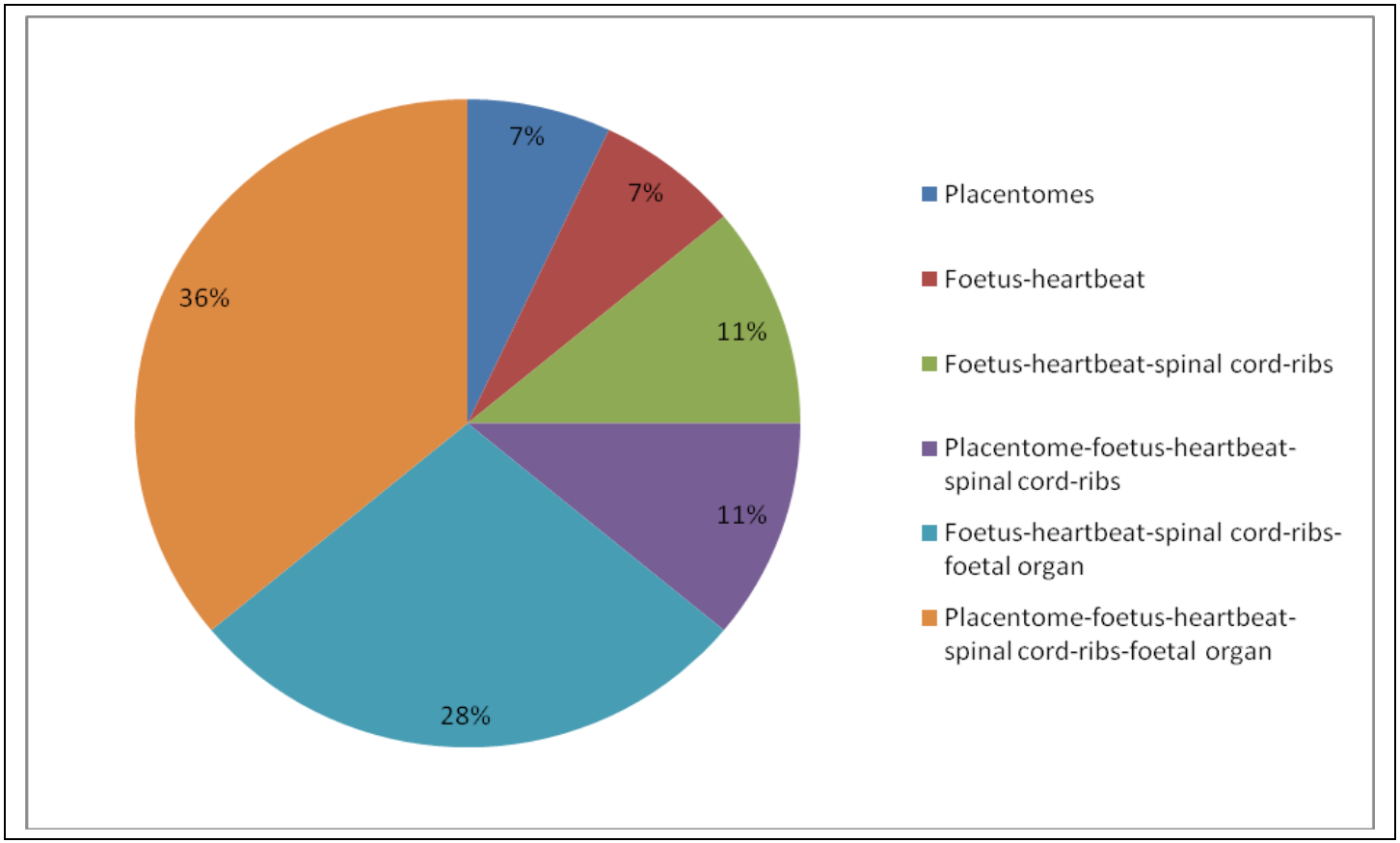


Figure 4.50**:** Pregnancy predictive value (percentage) of each structural image/combination of structures occurrence using transabdominal probe on late stage of gestation

Table 4.9: Image observation for each structure/combination of structures using transabdominal probe structures during final stage of gestation

N	Days	Placentome	Foetus	Heartbeat	Spinal cord	Ribs	Foetal organ	Foetus x heartbeat	Placentome x foetus x heartbeat	Foetus x heartbeat x spinal cord x ribs (optional)	Placentome x foetus x heartbeat x spinal cord x ribs	Foetus x heartbeat x spinal cord x ribs x foetal organ	Placentome x foetus x heartbeat x spinal cord x ribs x foetal organ
1	120	+	-	-	-	-	-	-	-	-	-	-	-
2*	121	+ (2)	-	-	-	-	-	-	-	-	-	-	-
1	124	+	-	-	-	-	-	-	-	-	-	-	-
1	127	+	-	-	-	-	-	-	-	-	-	-	-
2	130	+	-	-	-	-	-	-	-	-	-	-	+
1	146	+	-	-	-	-	-	-	-	-	-	-	-
8		7	0	0	0	0	0	0	0	0	0	0	1
Predictive value (%)		88	0	0	0	0	0	0	0	0	0	0	12

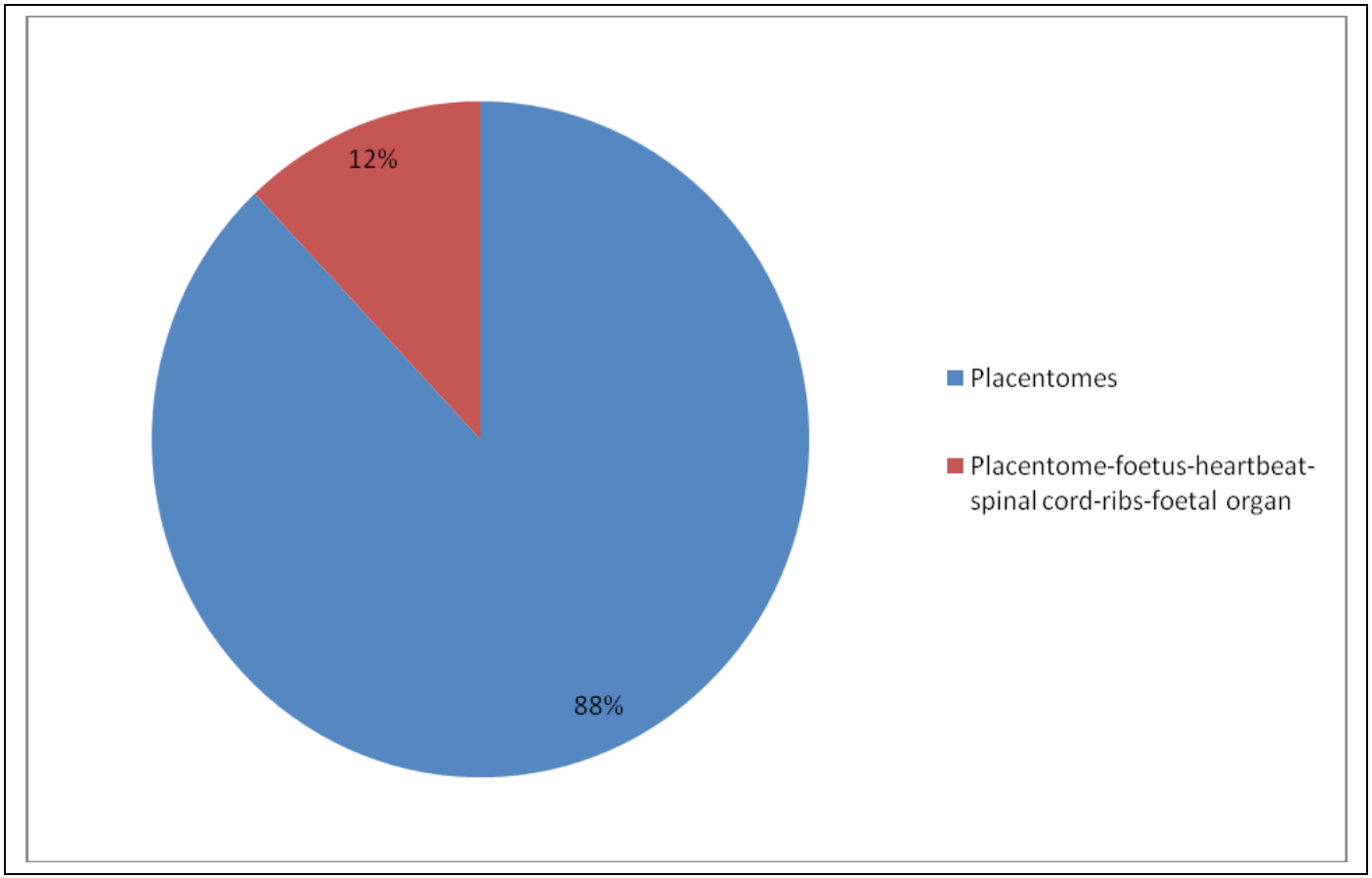


Figure 4.51**:** Pregnancy predictive value (percentage) of each structural image/combination of structures occurrence using transabdominal probe on final stage of gestation

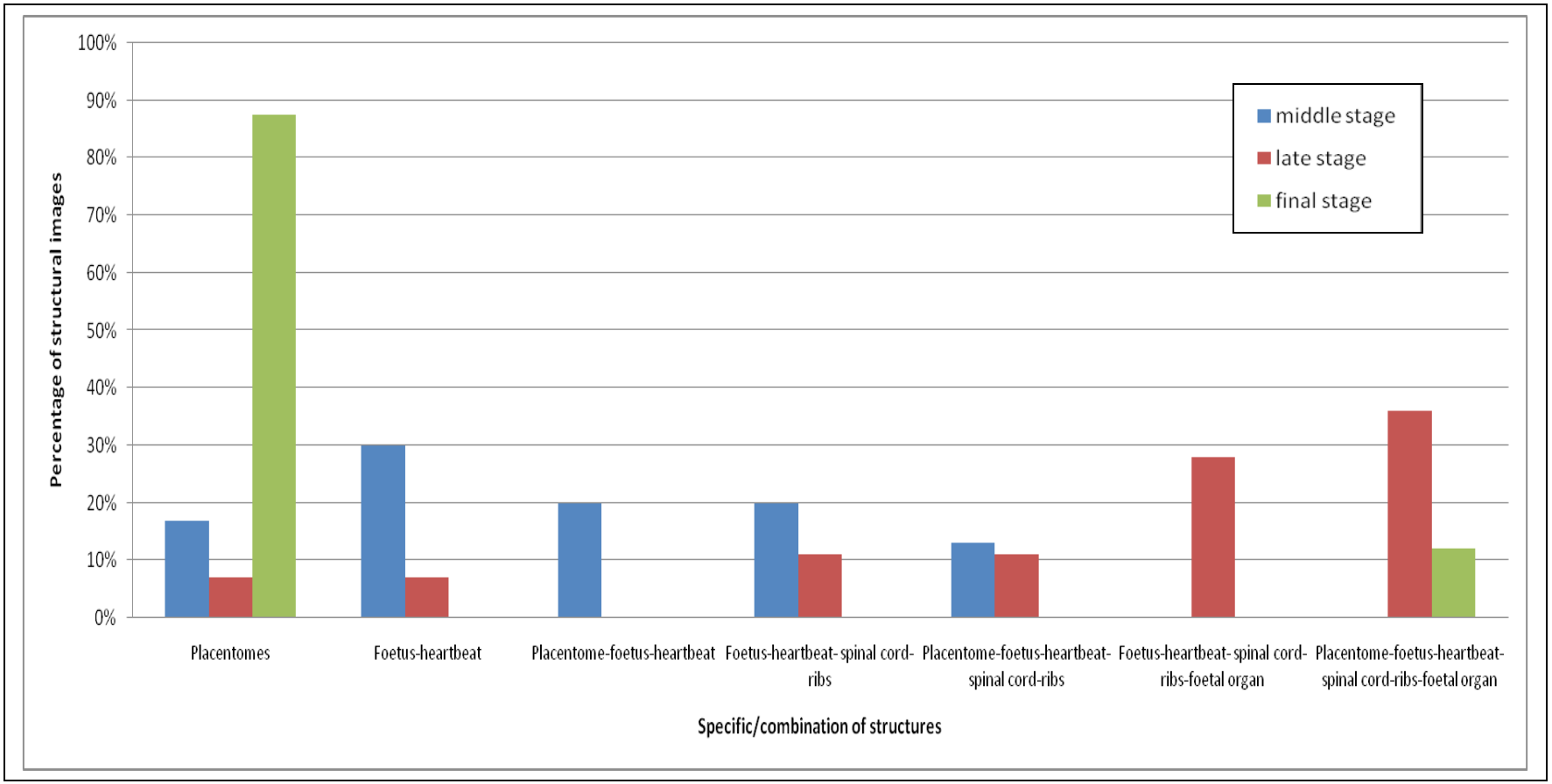


Figure 4.52: Summary of existence of structural images total images observed in middle, late and final stages of gestation using transabdominal probe

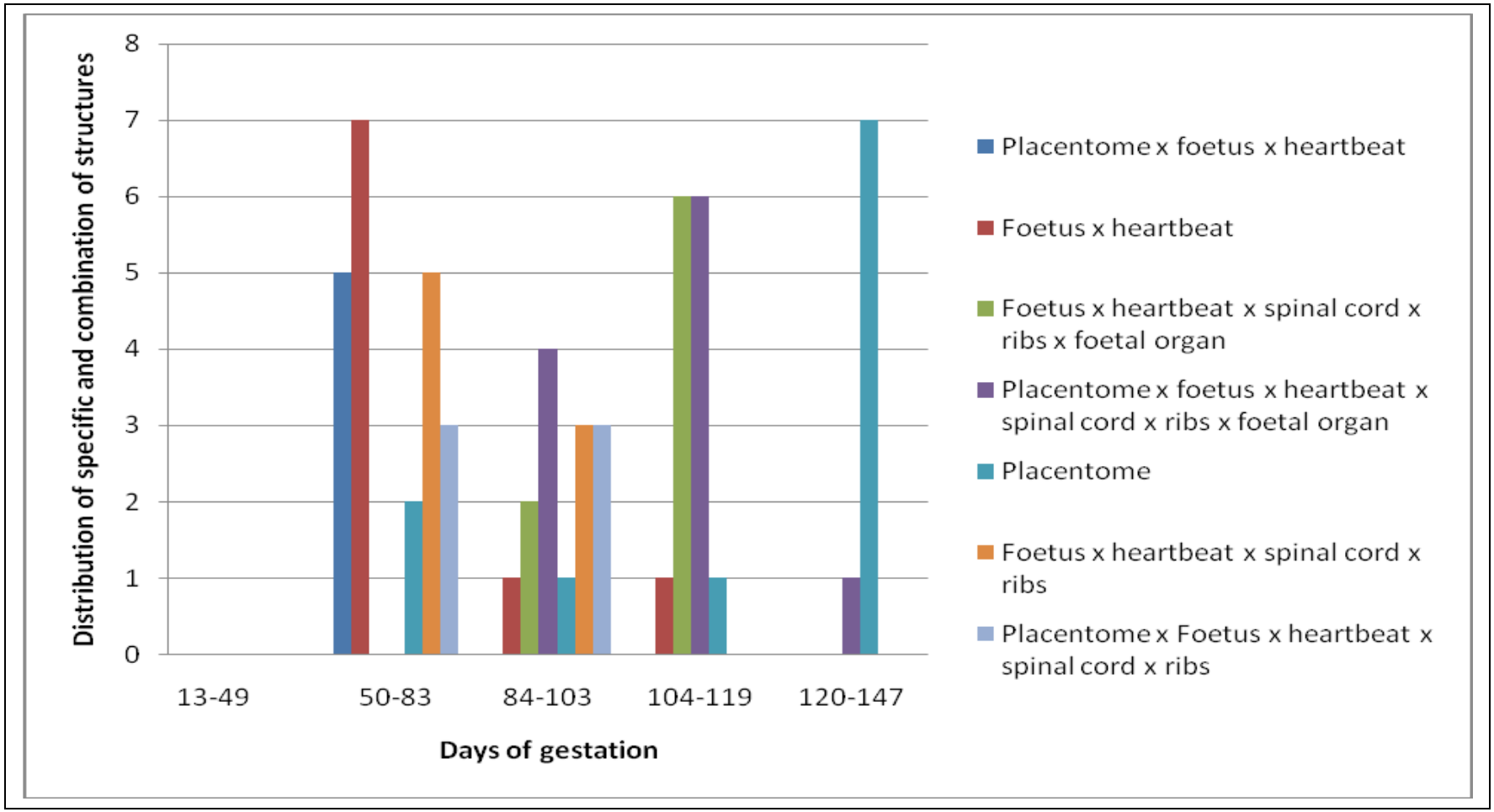


Figure 4.53 : Summary on frequency of singular and combinations of structural images observed along gestation period using transabdominal probe

Table 4.10: Number of animals that tested positive and negative with different stage of gestation

Diagnoses[x]	Stage of gestation		
	Middle n=37	Late n=36	Final n=11
a: Correct positive	24	28	8
b: Incorrect positive	1	0	0
c: Correct negative	11	8	3
d: Incorrect negative	1	0	0
e: Sensitivity (%)	96% (24/25)	100% (28/28)	100% (8/8)
f: Specificity (%)	92% (11/12)	100% (8/8)	100% (3/3)
g: Positive predictive value (%)	96% (24/25)	100% (28/28)	100% (8/8)
h: Negative predictive value %)	92% (11/12)	100% (8/8)	100% (3/3)
Overall accuracy (%)	94%	100%	100%

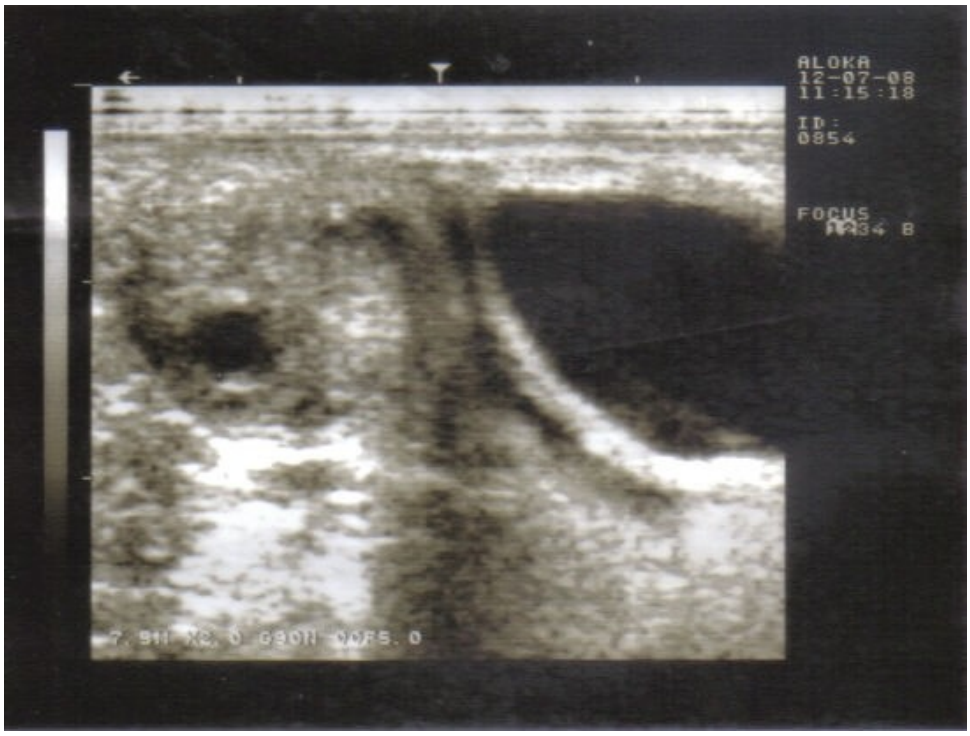
Note:
a : Pregnant does that were correctly diagnosed
b : Pregnant does that were incorrectly diagnosed
c : Non-pregnant does that were correctly diagnosed
d : Non-pregnant does that were incorrectly diagnosed
e : Sensitivity [a/(a + d)]
f : Specificity [c/(b + c)]
g : Positive predictive value [a/(a + b)]
h : Negative predictive value [c/(c + d)]
i : Overall accuracy (e + f + g + h /4)

[x] refers to the confirmation of does whether kidding or not kidding

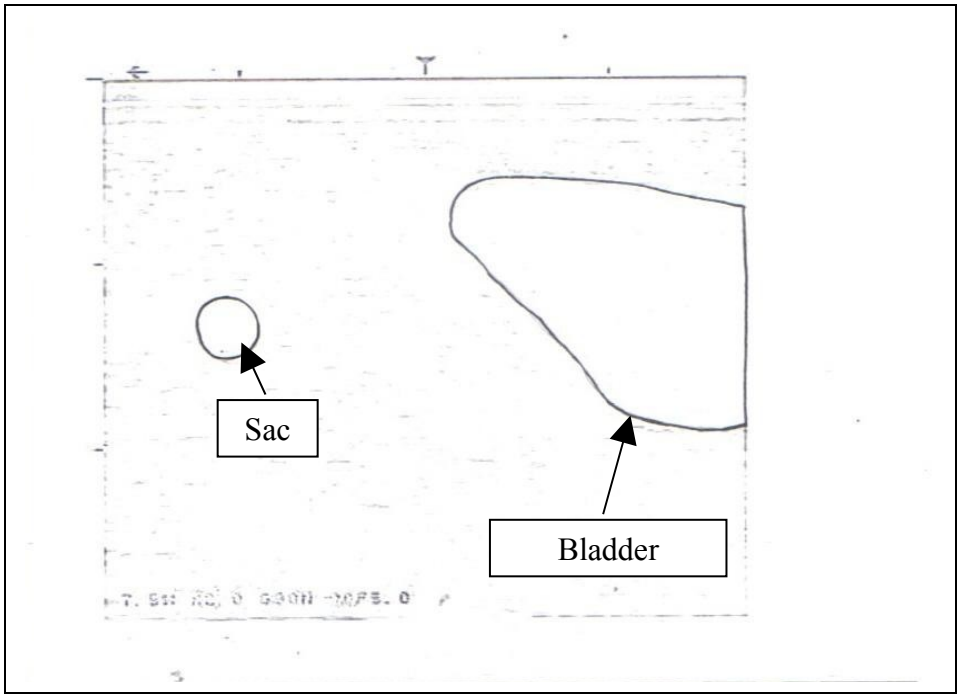
4.5 PREGNANCY DIAGNOSIS IN DOES UNDERGO NATURAL MATING AND AI WITH TRANSRECTAL AND TRANSABDOMINAL PROBES (EXPERIMENT 5)

In Experiment 5, a total of 75 does were used in the study. Table 4.11 shows prediction of specific and combinations of criteria obtained from Experiments 3 and 4 along pregnancy period. Specific and combinations of structures were initialized, i.e. E1, E2 and etc, for easier arrangements. Table 4.12 shows a summarized percentage of accuracy on pregnancy status and predicted day of gestation for 17 pregnant does using transrectal probe (based on kidding date). During early stage of pregnancy, a total of 13 and 4 does that undergo natural mating and AI were detected pregnant with combinations E1:sac (Figures 4.57-4.59), E2: non-echogenic (NE) area (Figures 4.60-4.62) and E3: foetus-uterine wall-amniotic fluid-heartbeat (Figures 4.63-4.66). Percent of accuracy for combinations of structures, i.e. E1, E2 and E3 gave 100% on days 21-28, 21-28 and 29-45 of gestation, respectively. During middle stage of pregnancy, combinations of structures, i.e. M1: foetus-heartbeat, M2: placentomes-foetus-heartbeat and M3: foetus-heartbeat-spinal cord-ribs (Figures 4.67-4.80) gave percent accuracy of 100% on range of days 50-71 and 72-83 of gestation for 12 pregnant does (8 does that underwent natural mating and 4 does with AI). A total of 15 and 4 does that underwent natural mating and AI were detected pregnant with different combinations L1: placentomes-foetus-heartbeat-spinal cord-ribs, L3: placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ and L4: foetus-heartbeat-spinal cord-ribs-foetal organ (Figures 4.81-4.105) during late stage of gestation. Combination of structures i.e. L1, L2 and L3 gave 100%, 80% and 100% accuracy from days 84 to 119 of gestation. Two does were misdiagnosed on range of days 104-119 with L3 combination. During final stage of pregnancy, a total of 3 and 1

does that underwent natural mating and AI were detected pregnant with detection of placentomes (F2) in Figures 4.106 and 4.107. Detection of placentomes gave 100% accuracy on pregnant status and age prediction from days 121-146 of gestation. Figure 4.56 shows occurrence of significant indicators i.e. specific and combinations of structures along gestation period with transrectal and transabdominal probes. Structures on days 21-28 and 29-45 of gestation were sac (6 times) and non-echogenic (NE) area (5 times) and foetus-uterine wall-amniotic fluid-heartbeat (6 times), respectively. On days 60-71 of gestation, combinations of structures were foetus-heartbeat (thrice) placentomes-foetus-heartbeat (thrice) and foetus-heartbeat-spinal cord-ribs (once). On days 72-83 and 84-91 of gestation, combinations of structures were placentomes-foetus-heartbeat (4 times) and placentomes-foetus-heartbeat-spinal cord-ribs (3 times), respectively. Occurrences of combinations of structures detected on days 92-119 of gestation were 10 and 7 times for placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ and foetus-heartbeat-spinal cord-ribs-foetal organ. On days 120-147 of gestation, occurrence for placentomes was 8 times. Table 4.17 shows accuracy values (%) for each combination on pregnant status and days of gestation using different probes. During early stage of gestation, accuracy was 100% for all combinations (E1, E2 and E3) using transrectal probe. All combinations during middle and final stages gave 100% accuracy. Combination during late stage for L1, L3 and L4 were 100%, 80% and 100% that gave 97% overall accuracy.

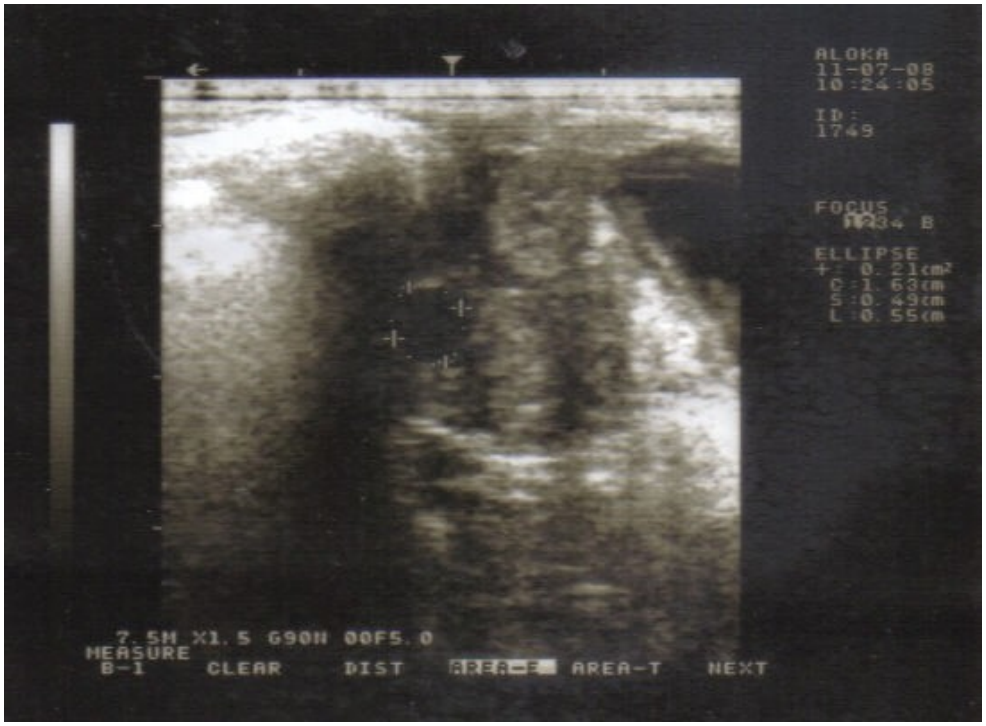


(A)

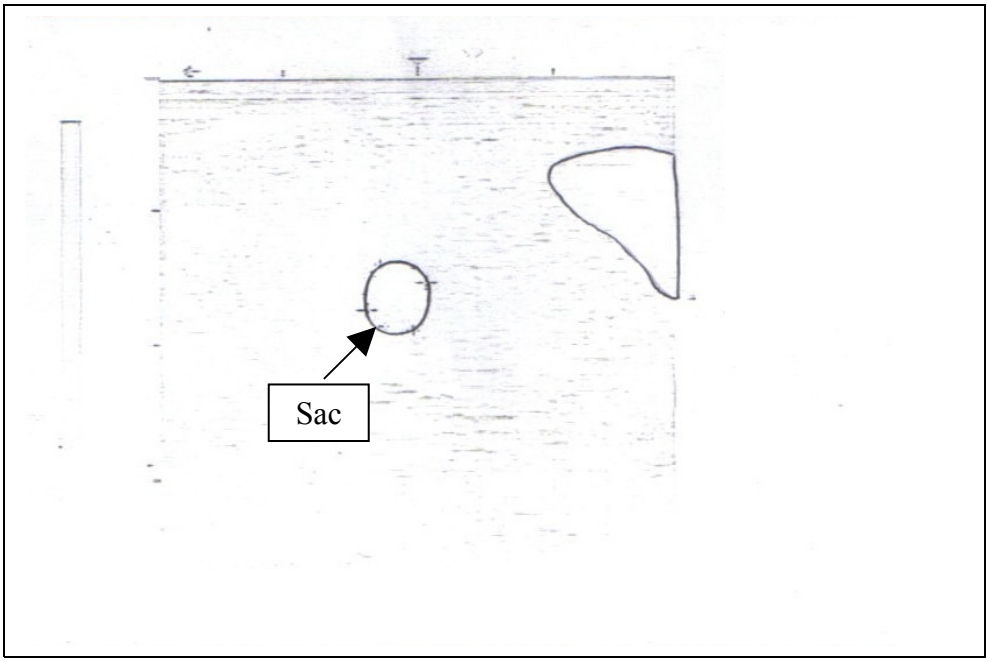


(B)

Figure 4.55: Image (A) is an original image. Sac was detected on day 23 of gestation (early stage). Image (B) is a labeled image.

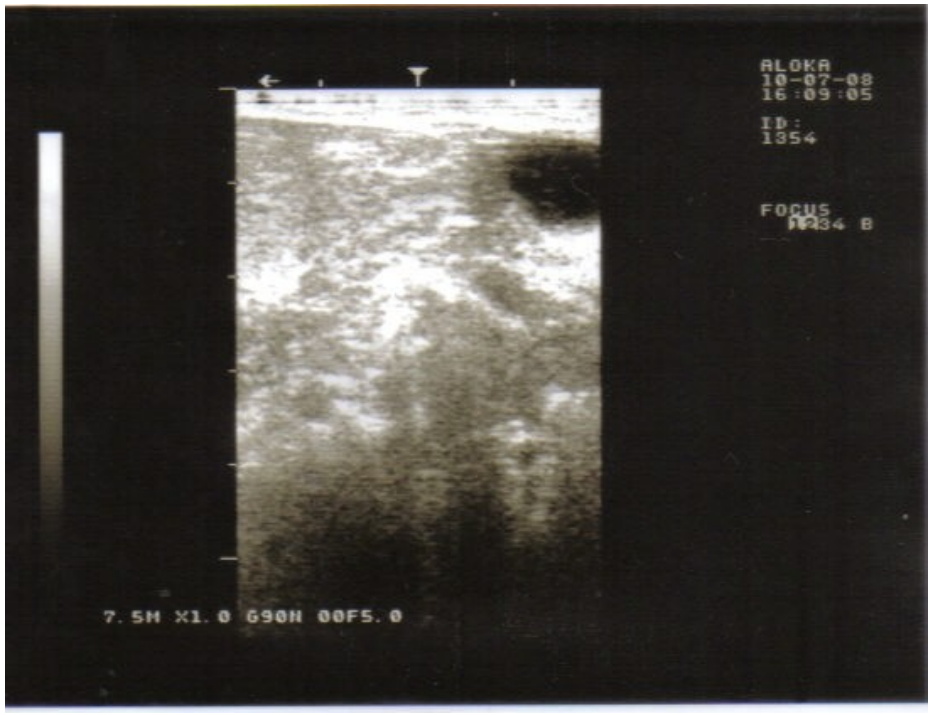


(A)

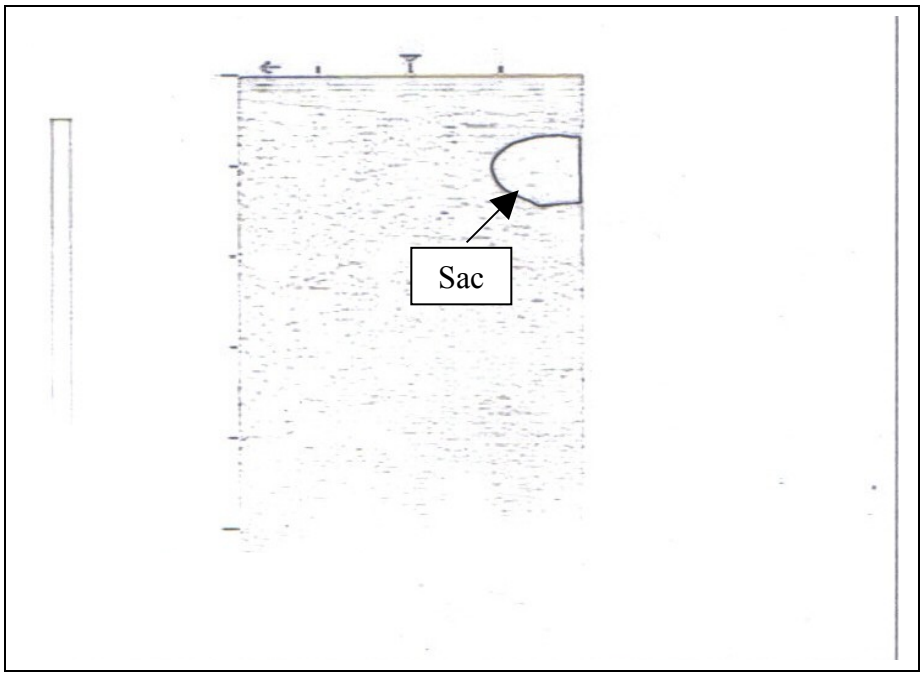


(B)

Figure 4.56: Image (A) is an original image. Sac was detected on day 23 of gestation (early stage). Image (B) is a labeled image.



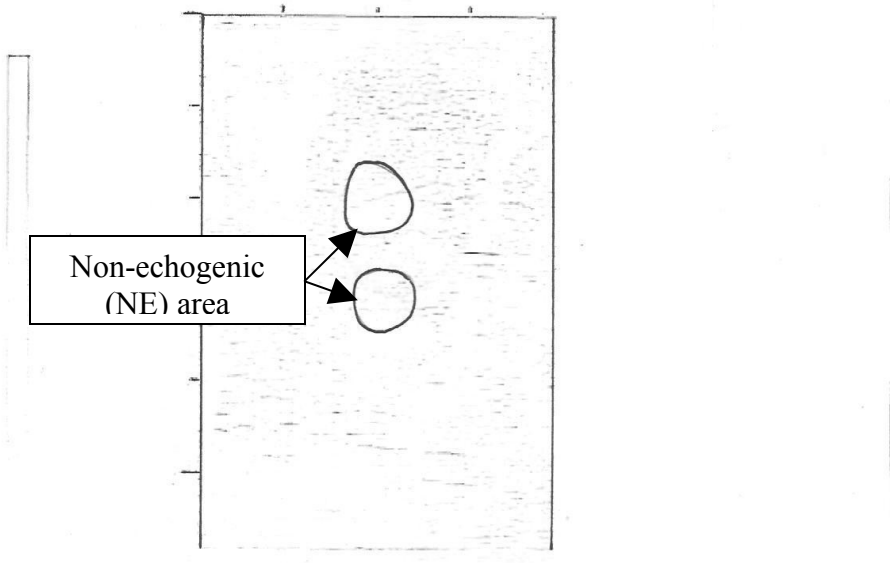
(A)



(B)

Figure 4.57: Image (A) is an original image. Sac was detected on day 25 of gestation (early stage). Image (B) is a labeled image.

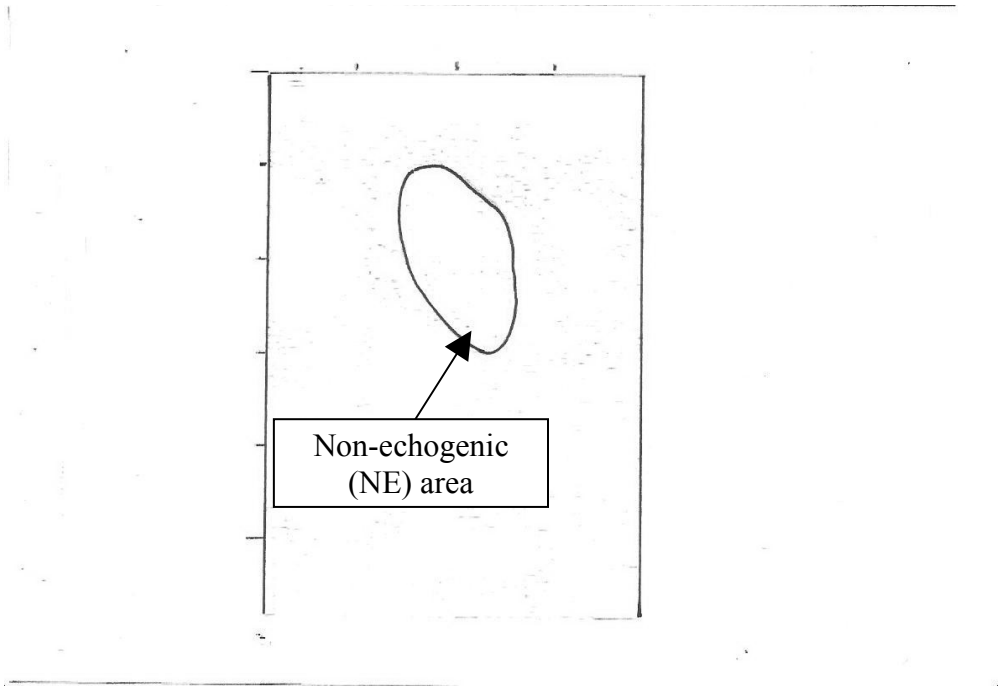
(A)



(B)

Figure 4.58: Image (A) is an original image. Non-echogenic (NE) area was detected on day 23 of gestation (early stage). Image (B) is a labeled image.

(A)

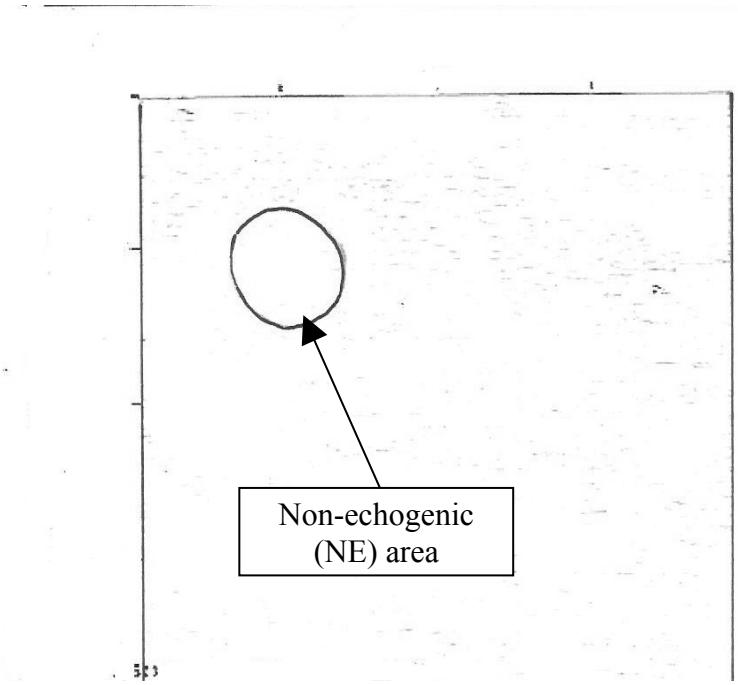


(B)

Figure 4.59: Image (A) is an original image. Non-echogenic (NE) area was detected on day 23 of gestation (early stage). Image (B) is a labeled image.

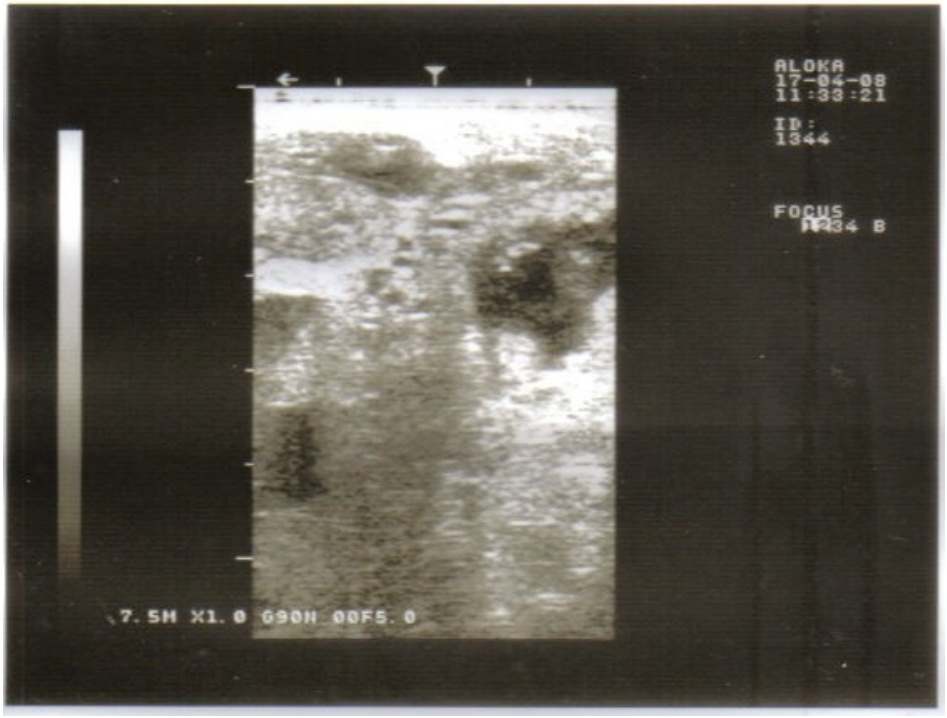
Foetus

(A)

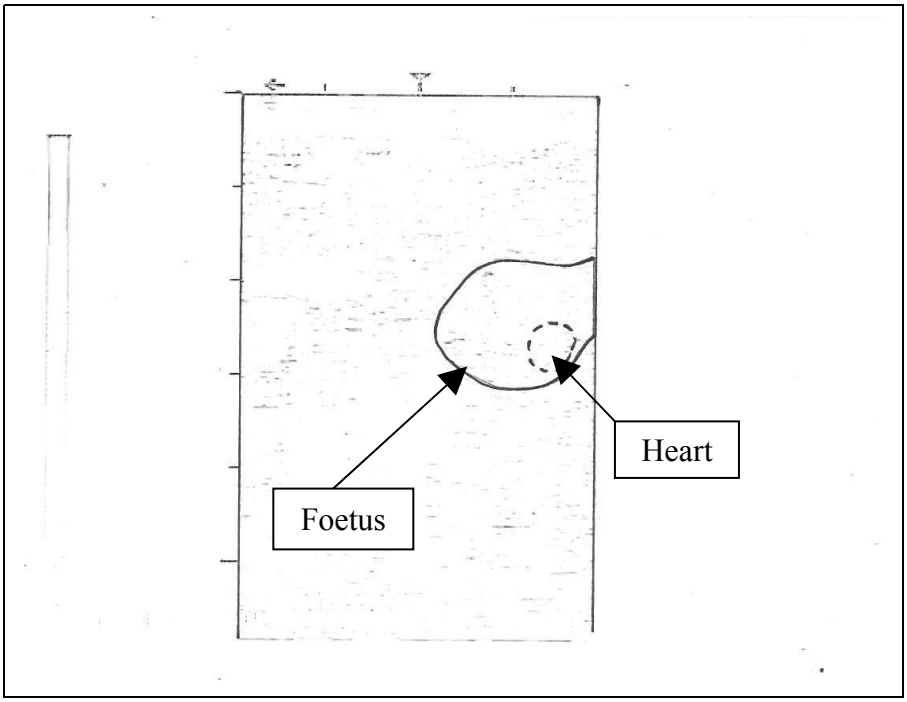


(B)

Figure 4.60: Image (A) is an original image. Non-echogenic (NE) area was detected on day 26 of gestation (early stage). Image (B) is a labeled image.

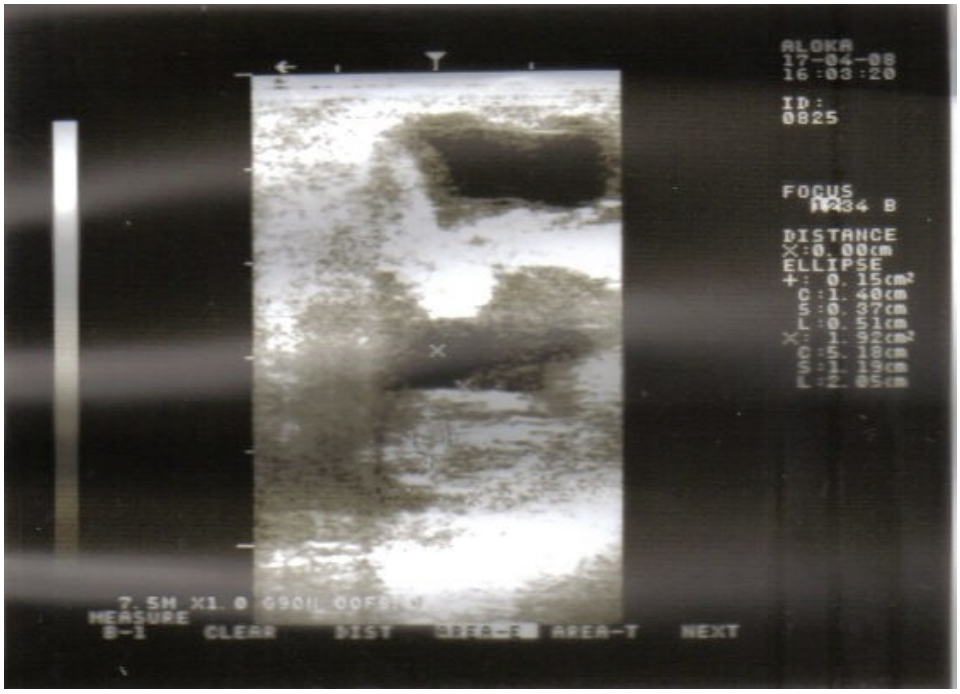


(A)

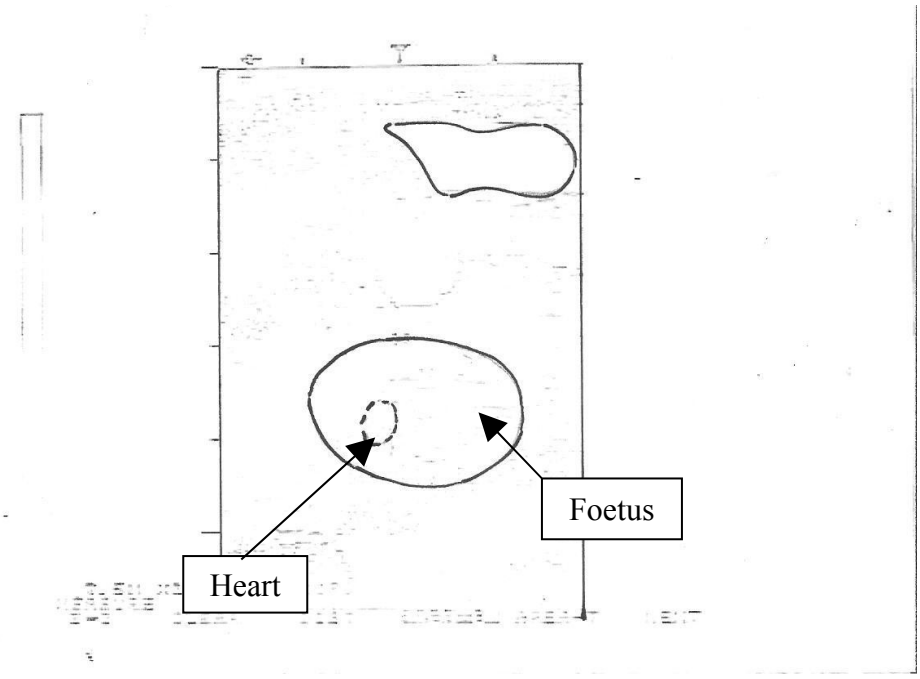


(B)

Figure 4.61: Image (A) is an original image. Foetus with heartbeat and amniotic fluid were detected on day 28 of gestation (early stage). Image (B) is a labeled image.



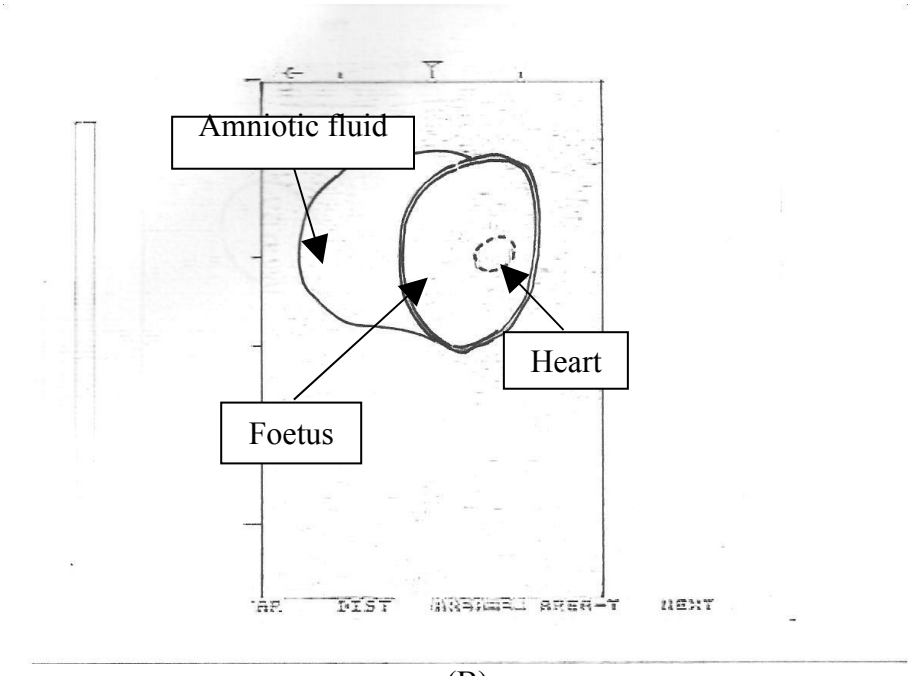
(A)



(B)

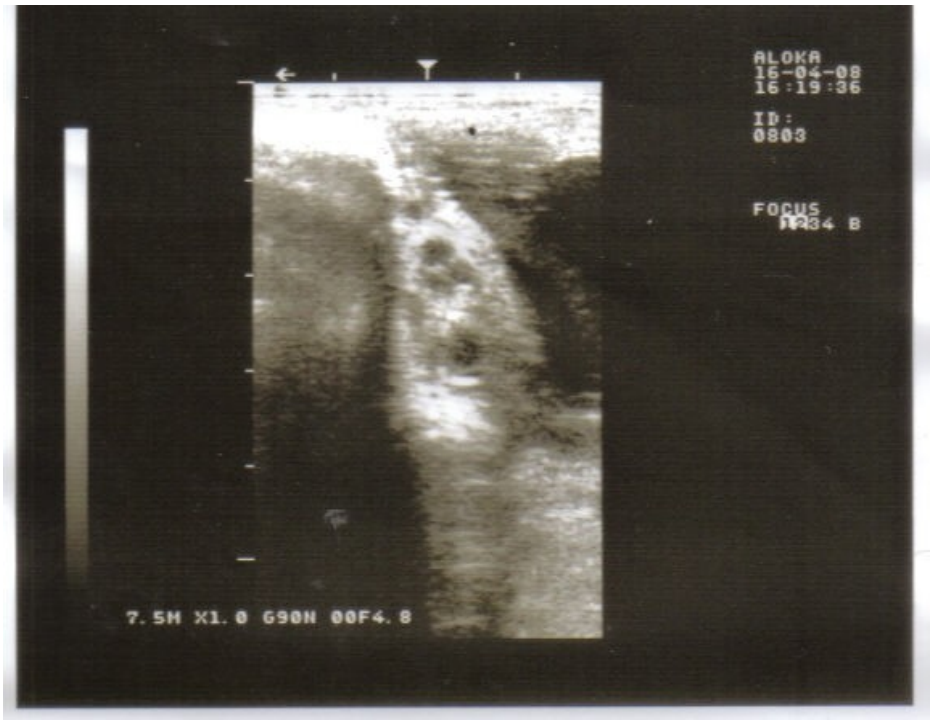
Figure 4.62: Image (A) is an original image. Foetus with heartbeat were detected on day 31 of gestation (early stage). Image (B) is a labeled image.

(A)

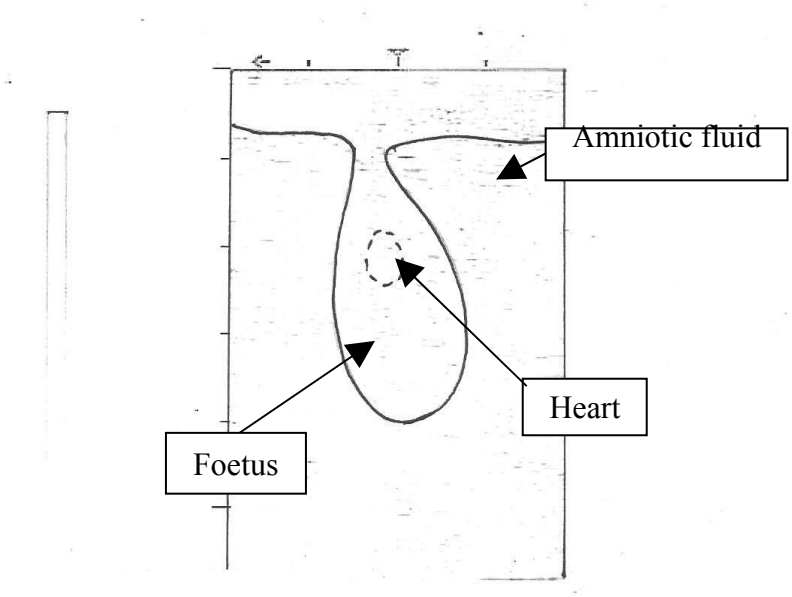


(B)

Figure 4.63: Image (A) is an original image. Foetus with heartbeat and amniotic fluid were detected on day 33 of gestation (early stage). Image (B) is a labeled image.



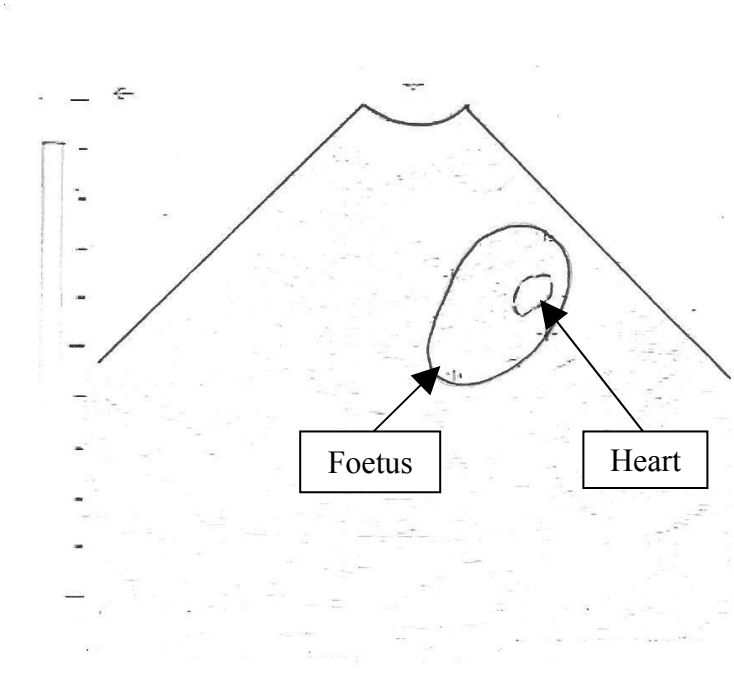
(A)



(B)

Figure 4.64: Image (A) is an original image. Foetus with heartbeat and amniotic fluid were detected on day 36 of gestation (early stage). Image (B) is a labeled image.

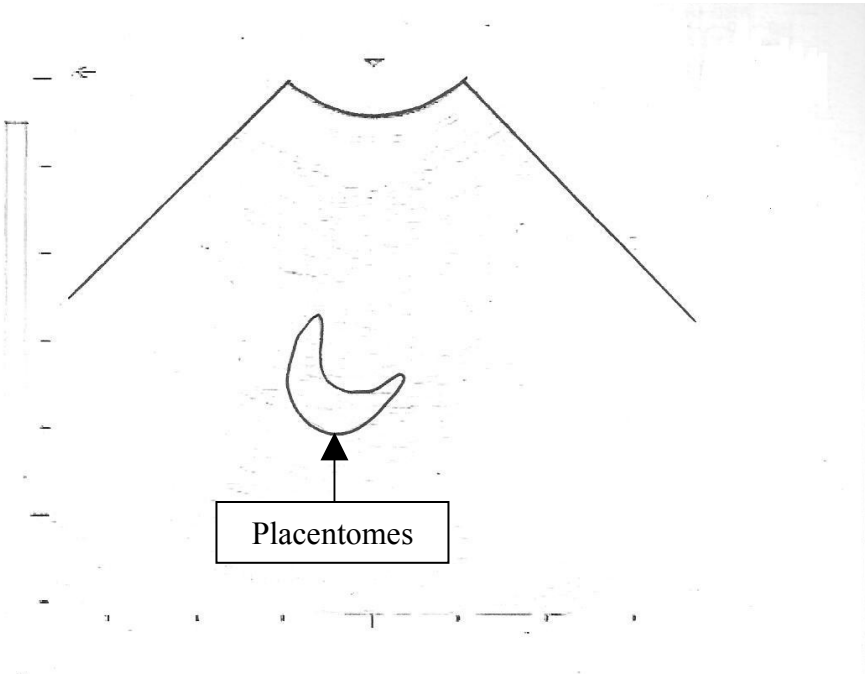
(A)



(B)

Figure 4.65: Image (A) is o an original image. Foetus and heartbeat were detected on day 60 of gestation (middle stage). Image (B) is a labeled image

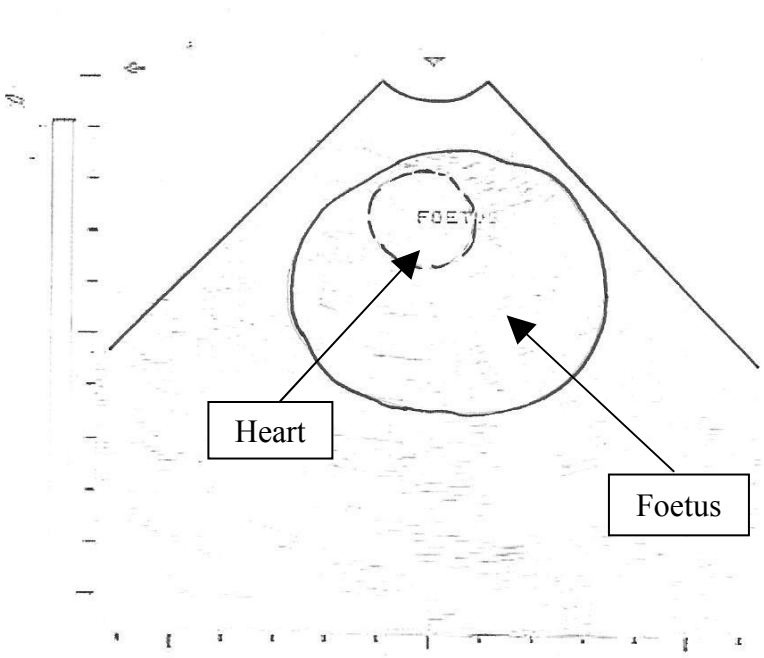
(A)



(B)

Figure 4.66: Image (A) is an original image. Placentomes were detected on day 60 of gestation (middle stage). Image (B) is a labeled image.

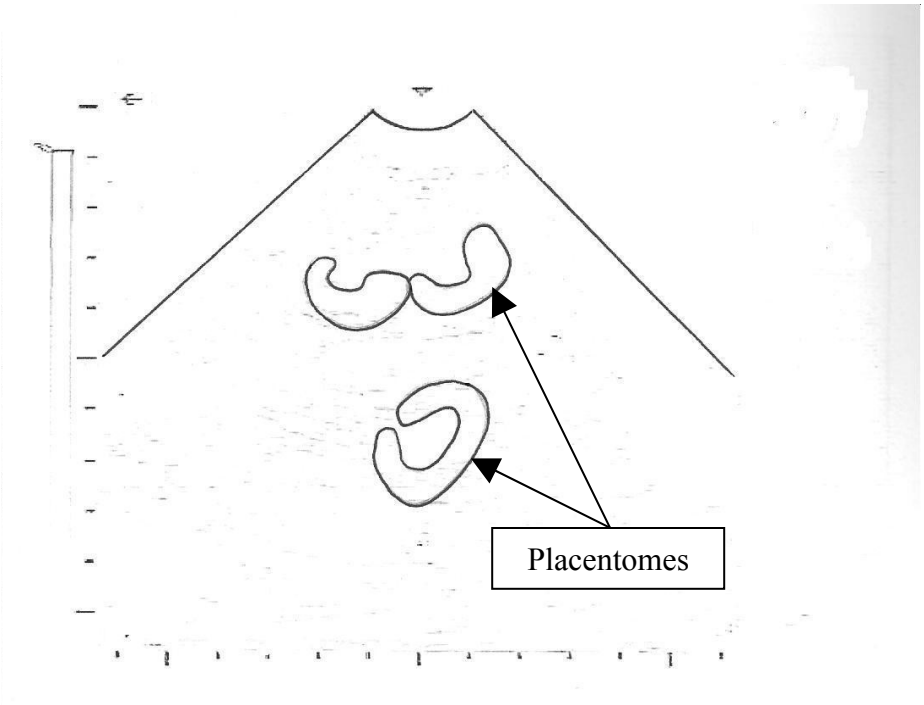
(A)



(B)

Figure 4.67: Image (A) is an original image. Foetus and heartbeat were detected on day 60 of gestation (middle stage). Image (B) is a labeled image.

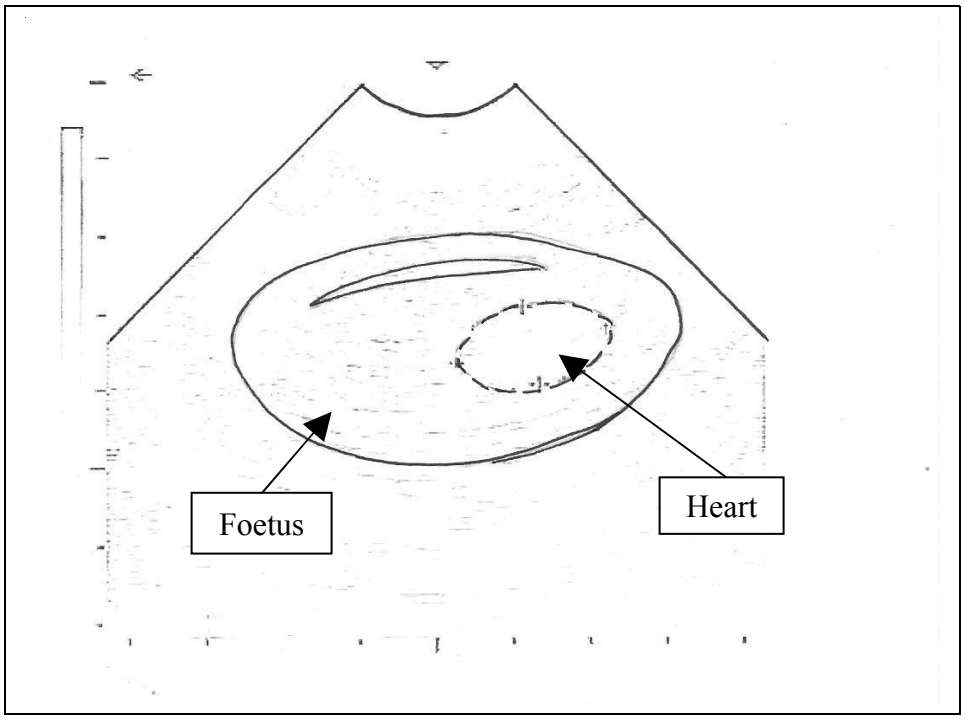
(A)



(B)

Figure 4.68: Image (A) is an original image. Placentomes were detected on day 60 of gestation (middle stage). Image (B) is a labeled image.

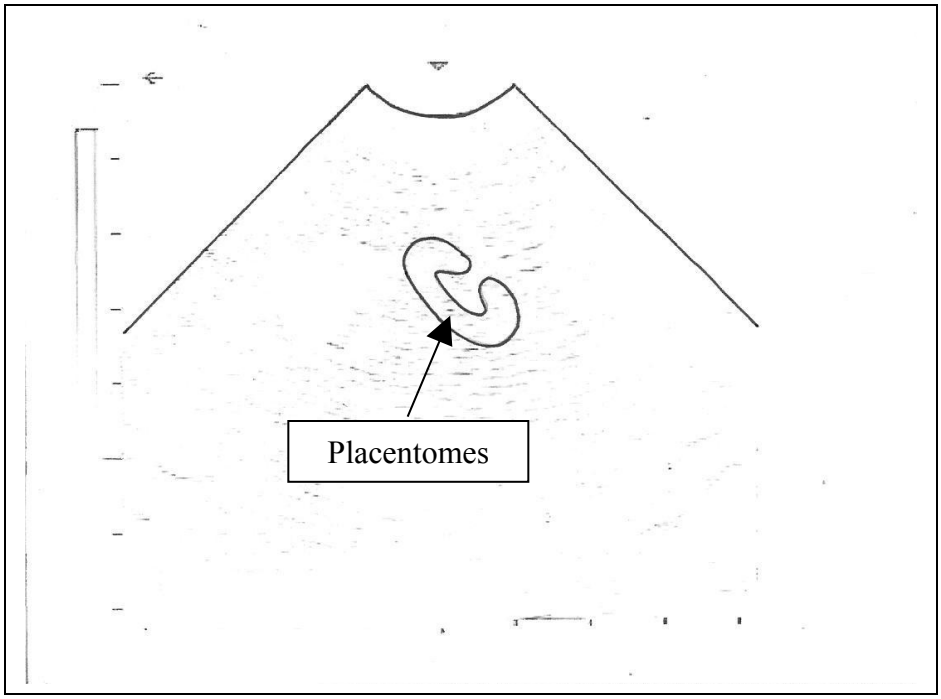
(A)



(B)

Figure 4.69: Image (A) is an original image. Foetus and heartbeat were detected on day 65 of gestation (middle stage). Image (B) is a labeled image.

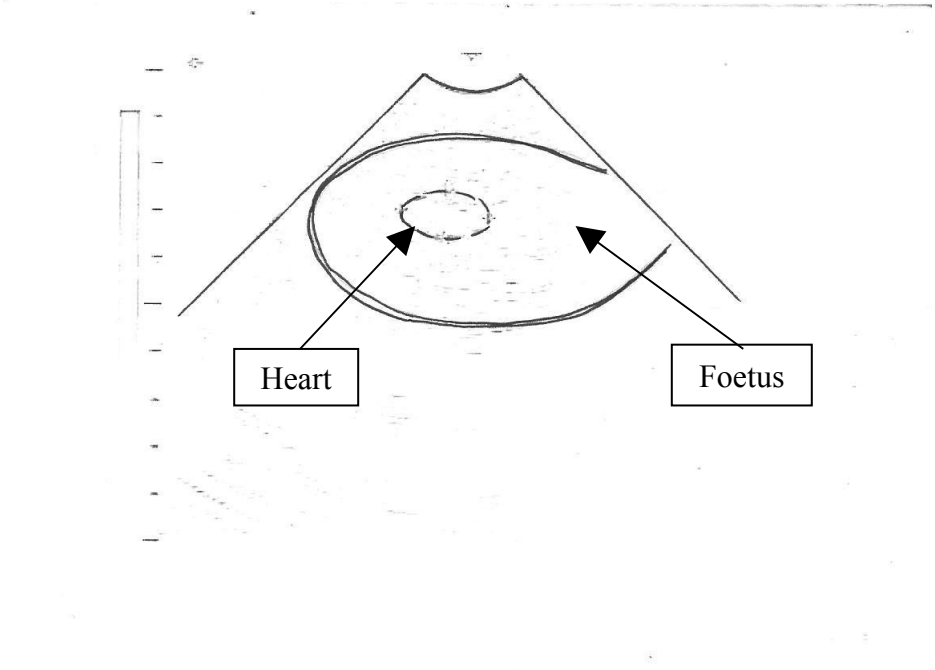
(A)



(B)

Figure 4.70: Image (A) is an original image. Placentomes were detected on day 65 of gestation (middle stage). Image (B) is a labeled image.

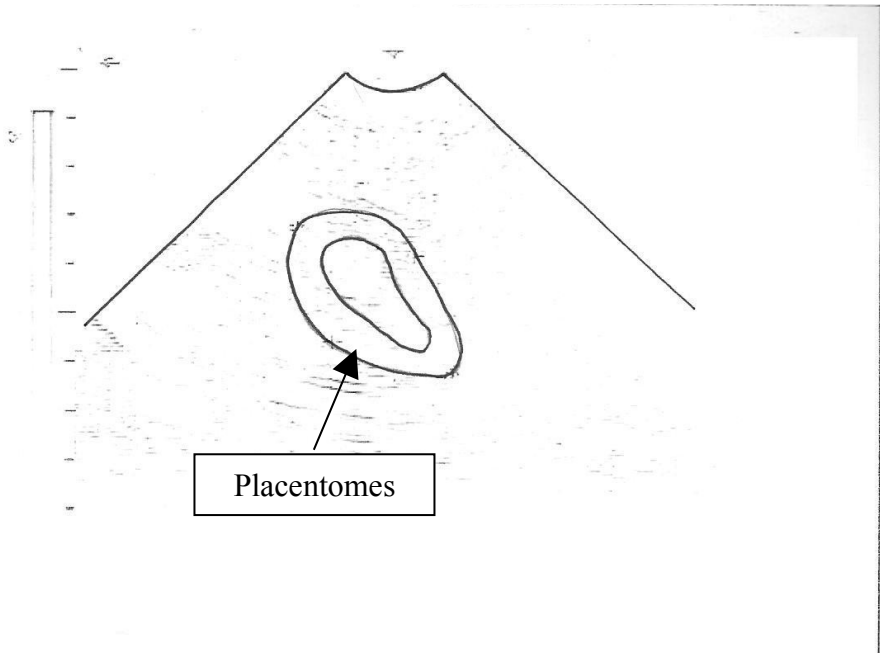
(A)



(B)

Figure 4.71: Image (A) is an original image. Foetus and heartbeat were detected on day 75 of gestation (middle stage). Image (B) is a labeled image.

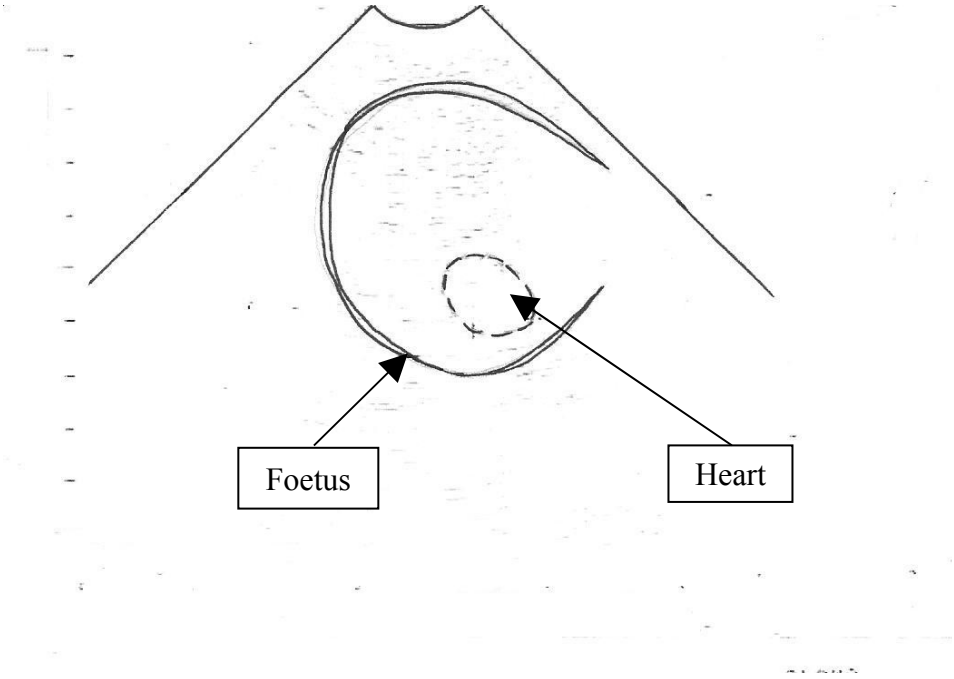
(A)



(B)

Figure 4.72: Image (A) is an original image. Placentomes was detected on day 75 of gestation (middle stage). Image (B) is a labeled image.

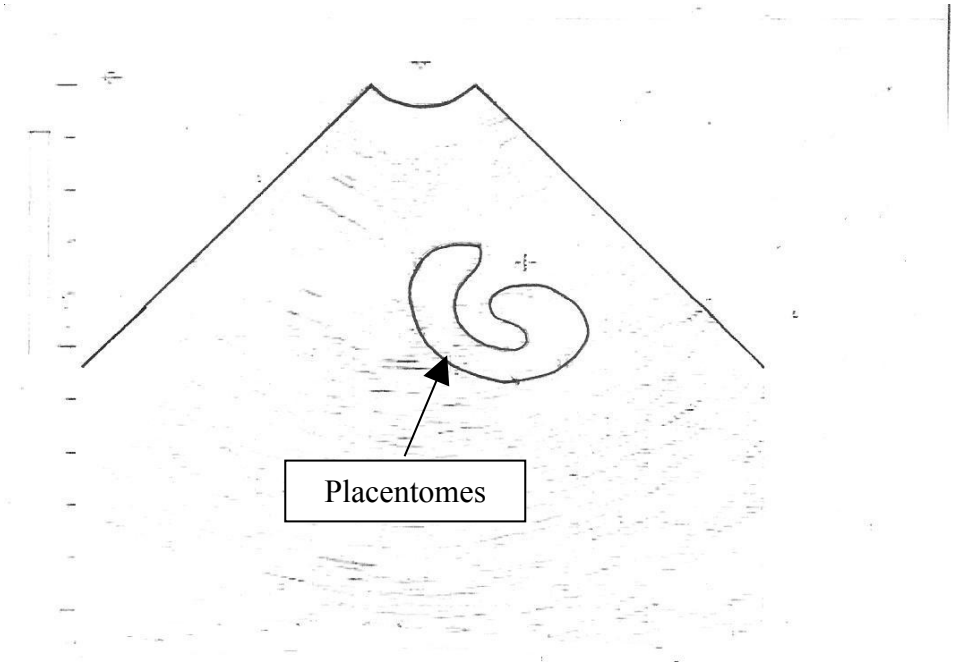
(A)



(B)

Figure 4.73: Image (A) is an original image. Foetus and heartbeat were detected on day 77 of gestation (middle stage). Image (B) is a labeled image.

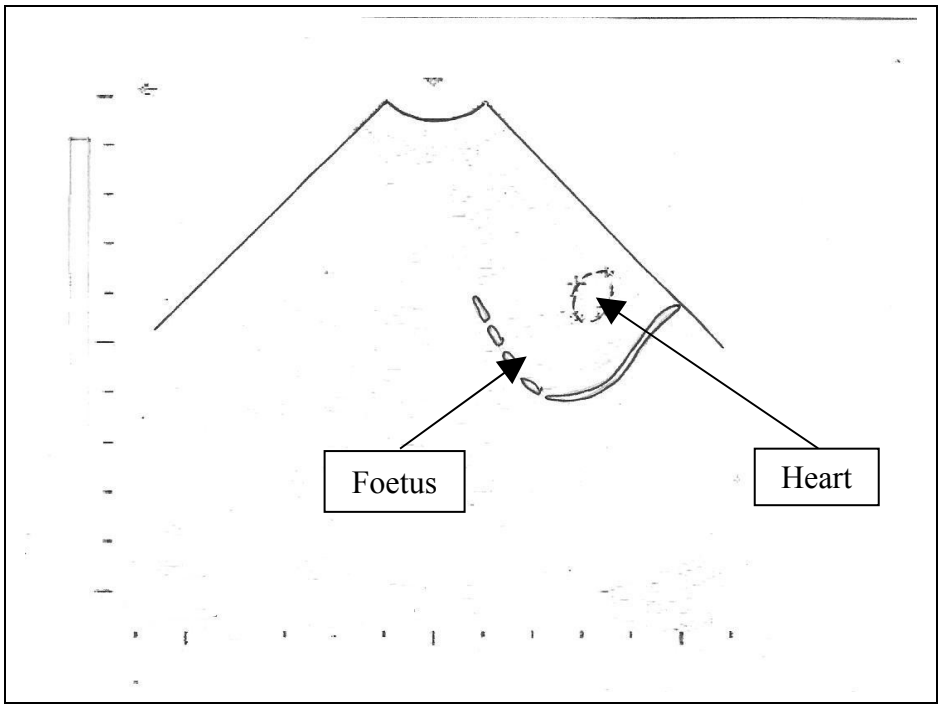
(A)



(B)

Figure 4.74: Image (A) is an original image. Placentomes were detected on day 77 of gestation (middle stage). Image (B) is a labeled image.

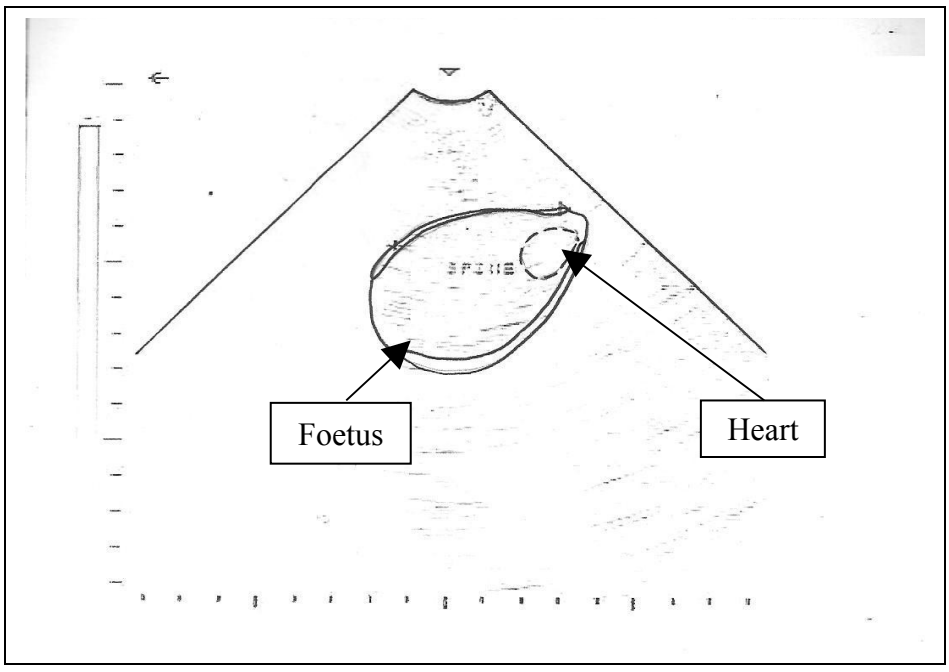
(A)



(B)

Figure 4.75: Image (A) is an original image. Foetus and heartbeat were detected on day 82 of gestation (middle stage). Image (B) is a labeled image.

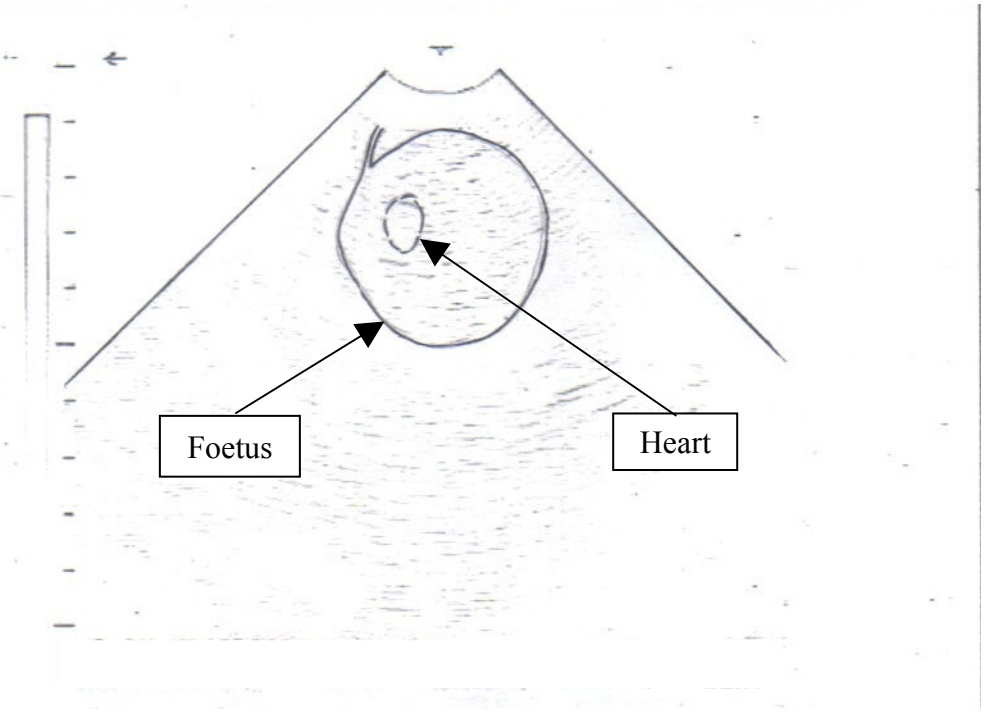
(A)



(B)

Figure 4.76: Image (A) is an original image. Foetus and heartbeat were detected on day 82 of gestation (middle stage). Image (B) is a labeled image.

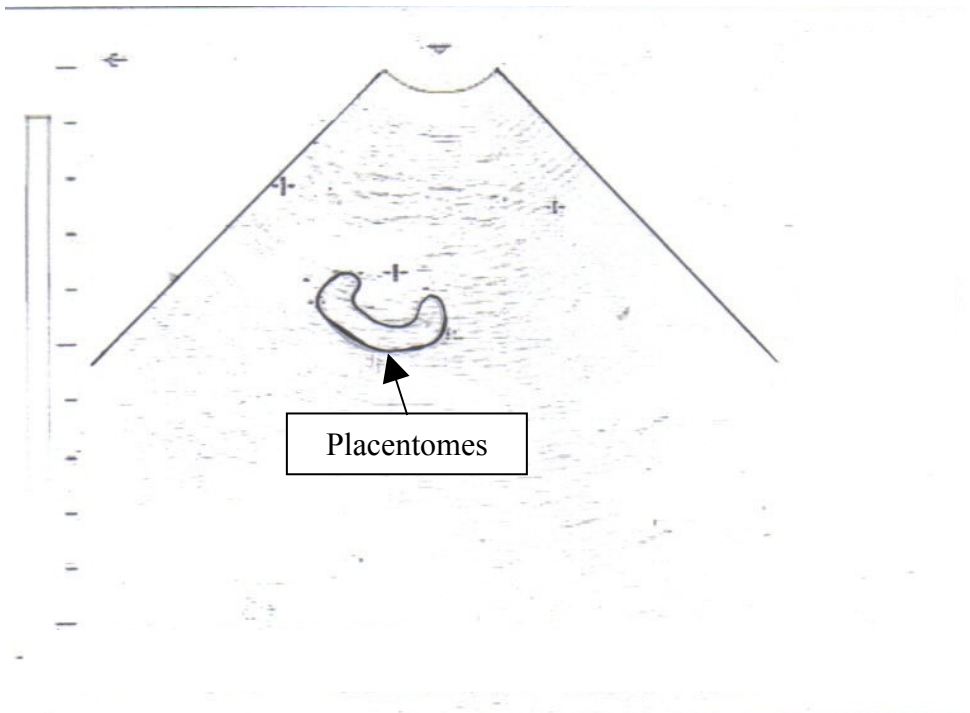
(A)



(B)

Figure 4.77: Image (A) is an original image. Foetus and heartbeat were detected on day 70 of gestation (middle stage). Image (B) is a labeled image.

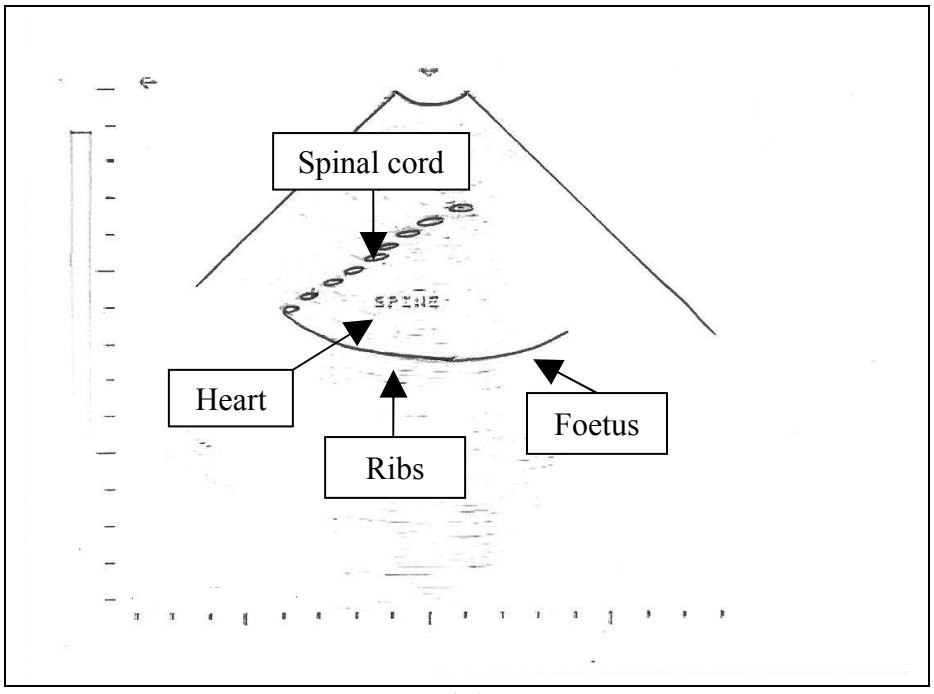
(A)



(B)

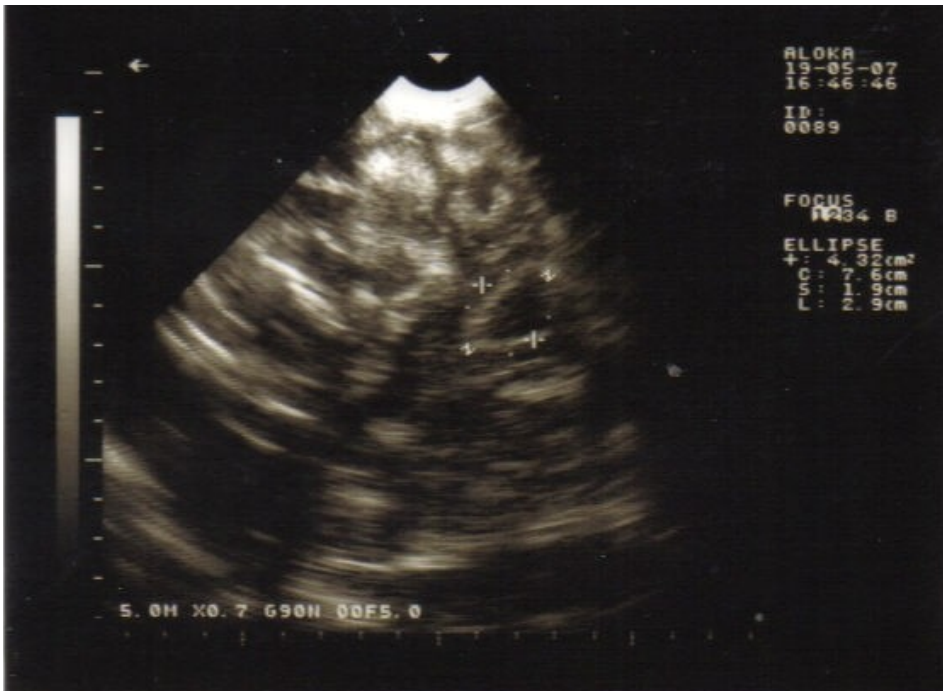
Figure 4.78: Image (A) is an original image. Placentomes were detected on day 70 of gestation (middle stage). Image (B) is a labeled image.

(A)

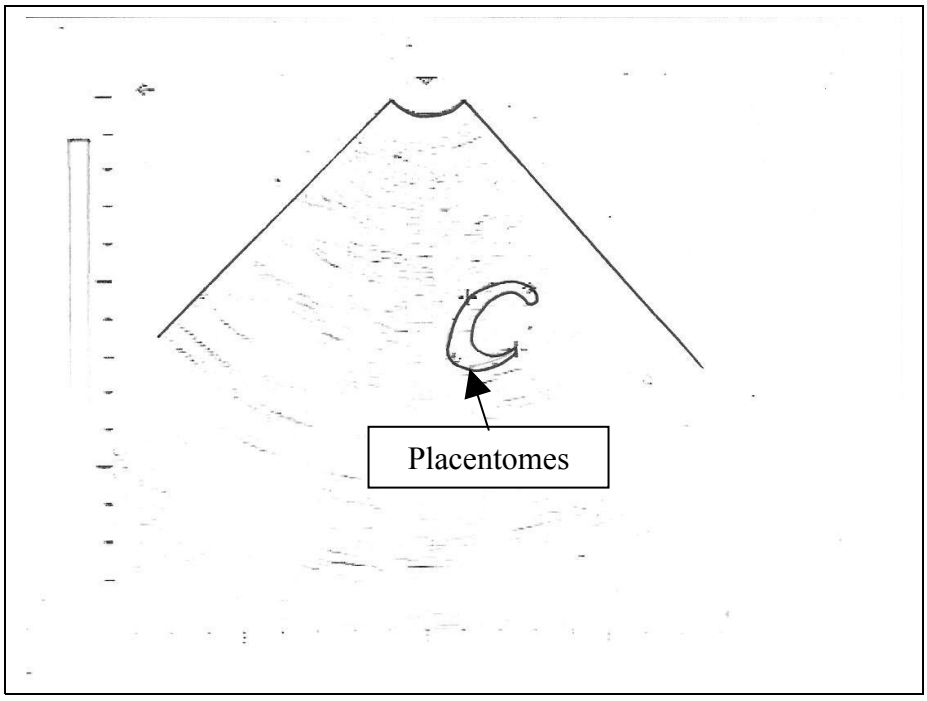


(B)

Figure 4.79: Image (A) is an original image. Foetus with heartbeat, spinal cord and ribs were detected on day 90 of gestation (late stage). Image (B) is a labeled image.



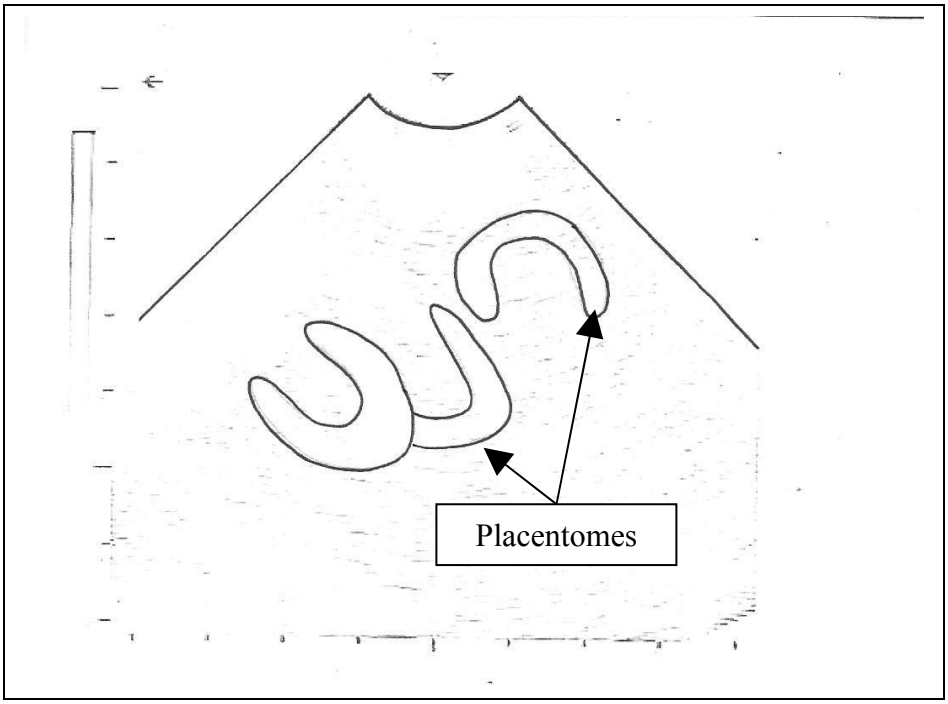
(A)



(B)

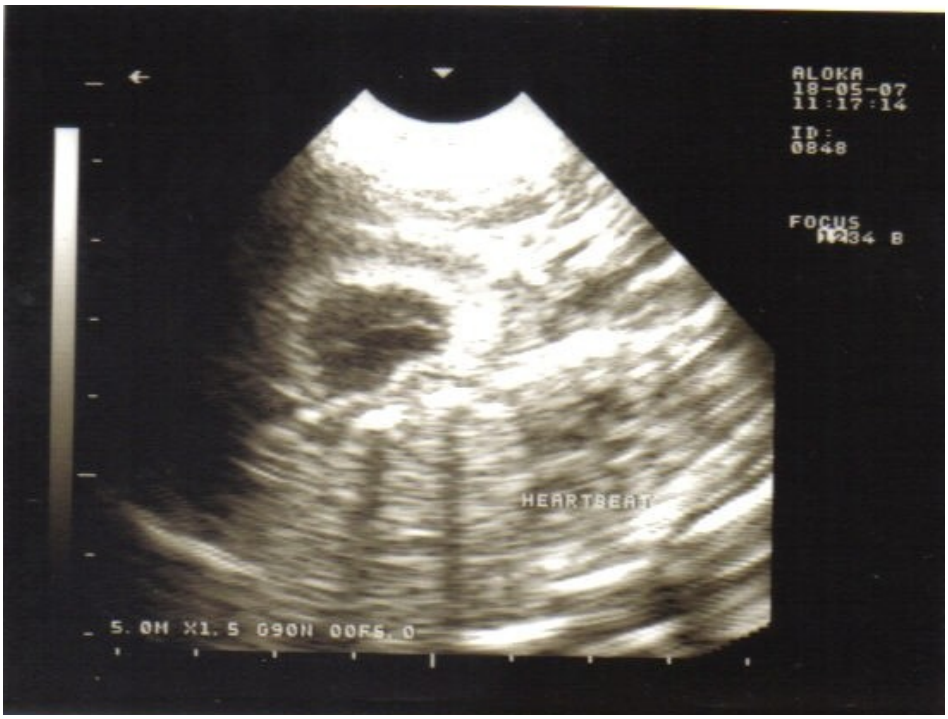
Figure 4.80: Image (A) is an original image. Placentomes were detected on day 90 of gestation (late stage).Image (B) is a labeled image.

(A)

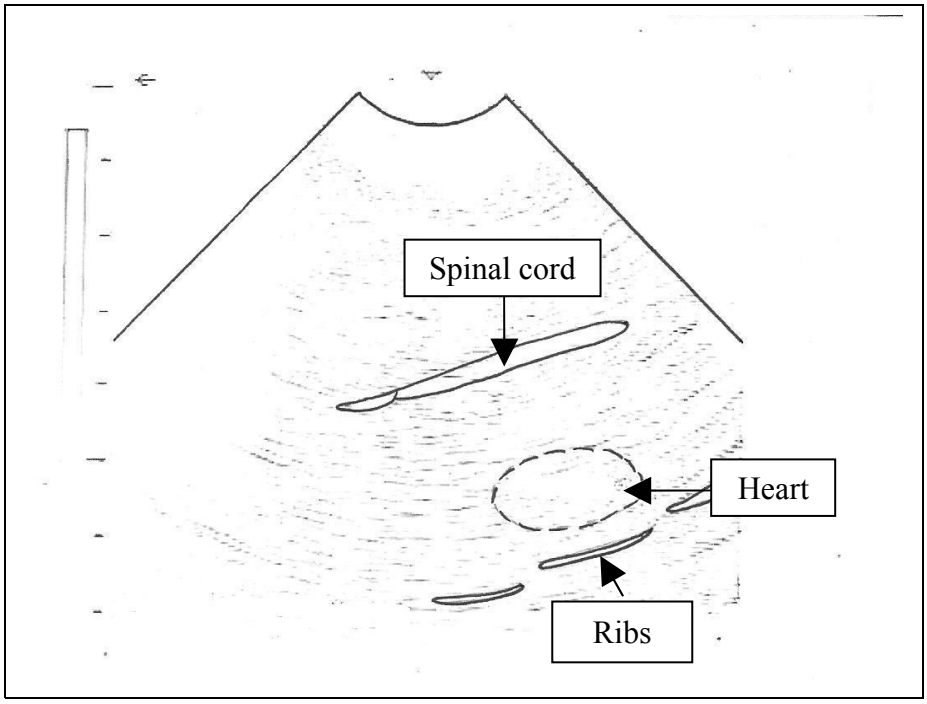


(B)

Figure 4.81: Image (A) is an original image. Placentomes were detected on day 91 of gestation (late stage). Image (B) is a labeled image.



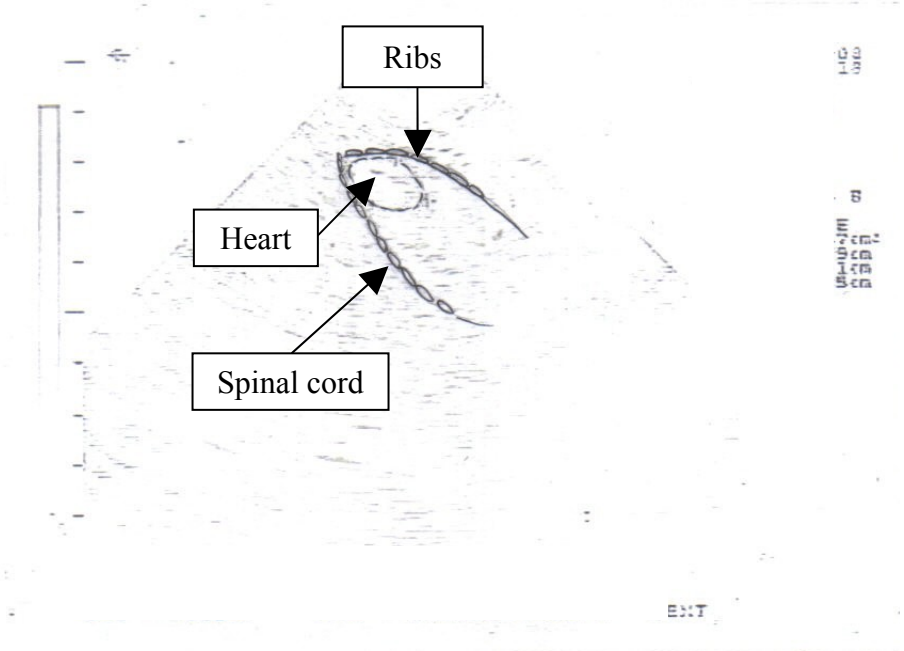
(A)



(B)

Figure 4.82: Image (A) is an original image. Foetus with heartbeat, spinal cord and ribs were detected on day 91 of gestation (late stage).Image (B) is a labeled image.

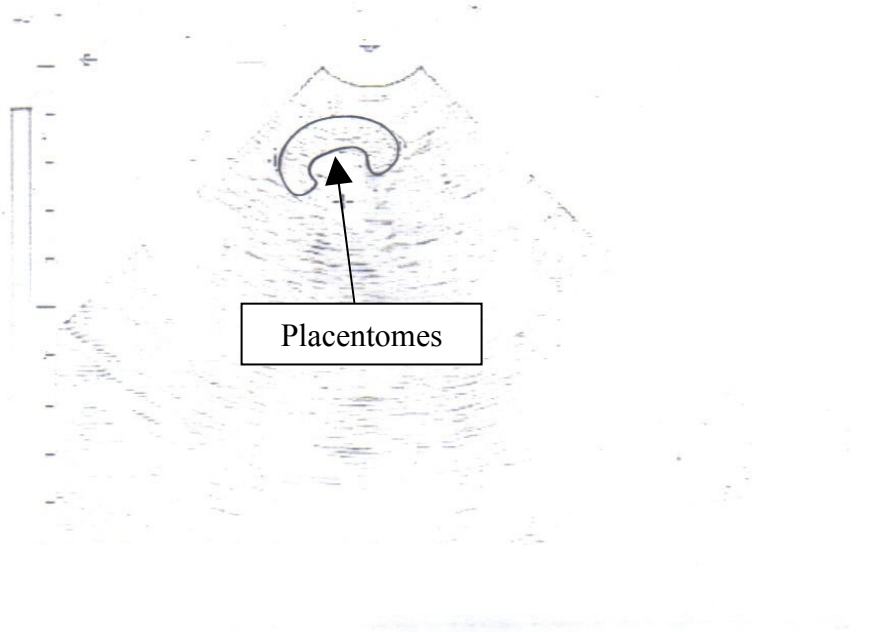
(A)



(B)

Figure 4.83: Image (A) is an original image. Foetus with heartbeat, spinal cord, and ribs were detected on day 93 of gestation (late stage). Image (B) is a labeled image.

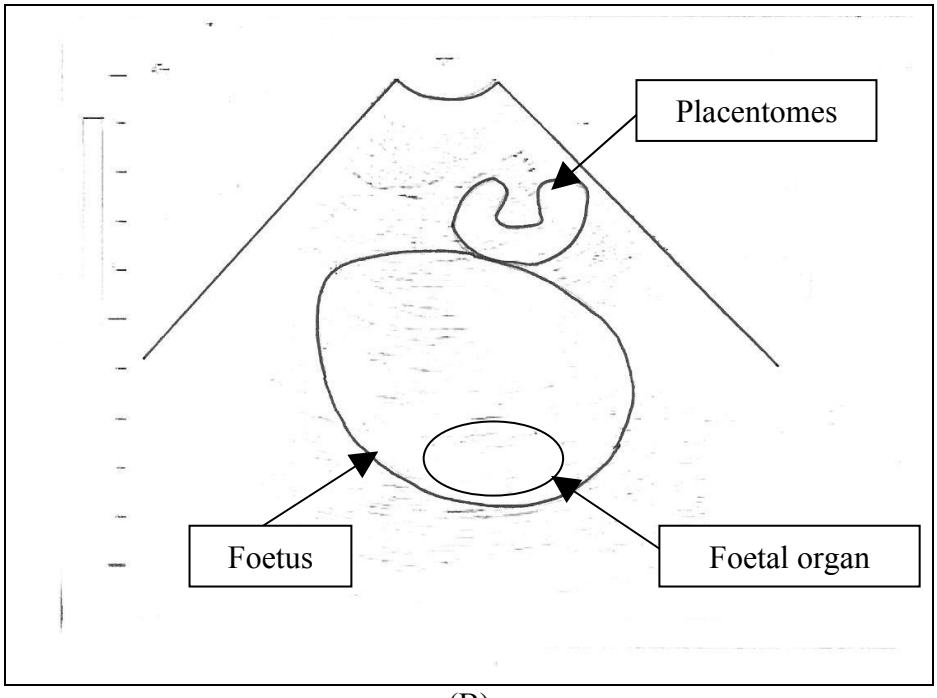
(A)



(B)

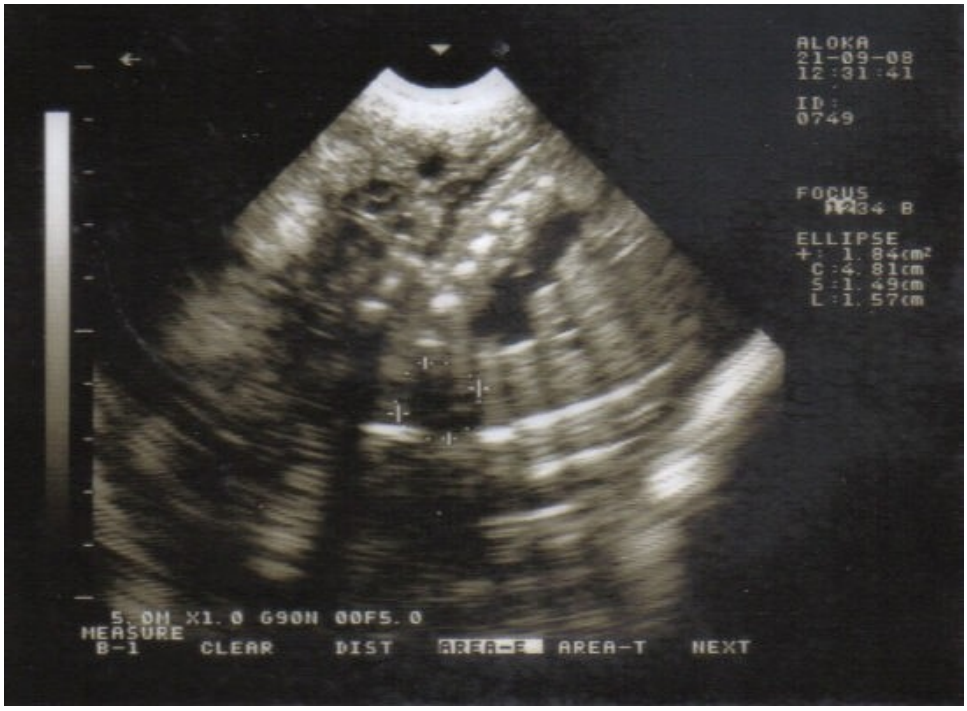
Figure 4.84: Image (A) is an original image. Placentomes were detected on day 93 of gestation (late stage).Image (B) is a labeled image.

(A)

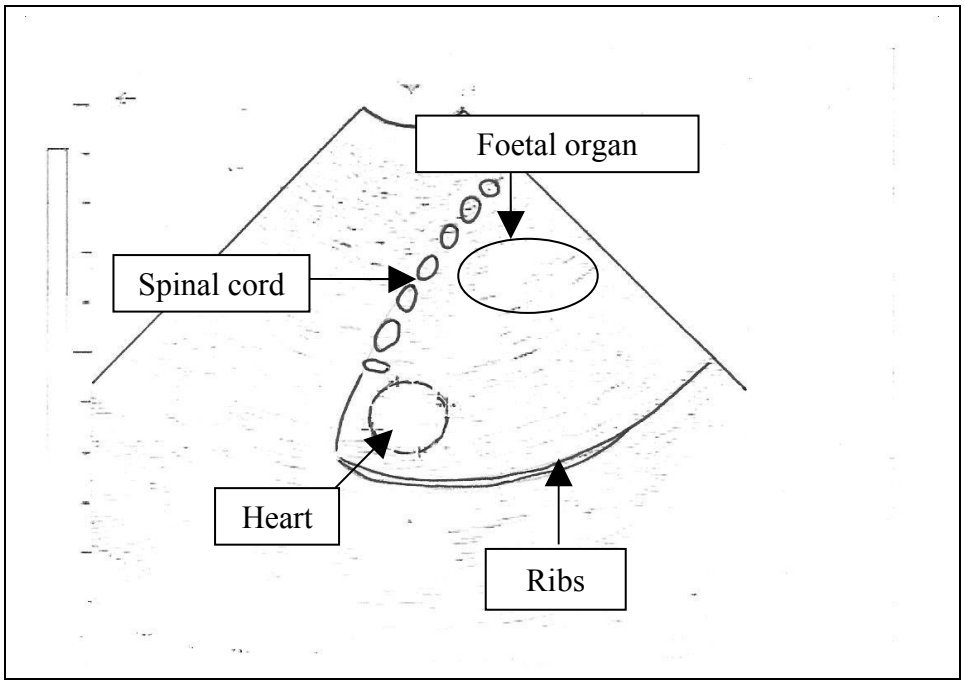


(B)

Figure 4.85: Image (A) is an original image. Placentomes, foetus with heartbeat and foetal organ were detected on day 95 of gestation (late stage).Image (B) is a labeled image.



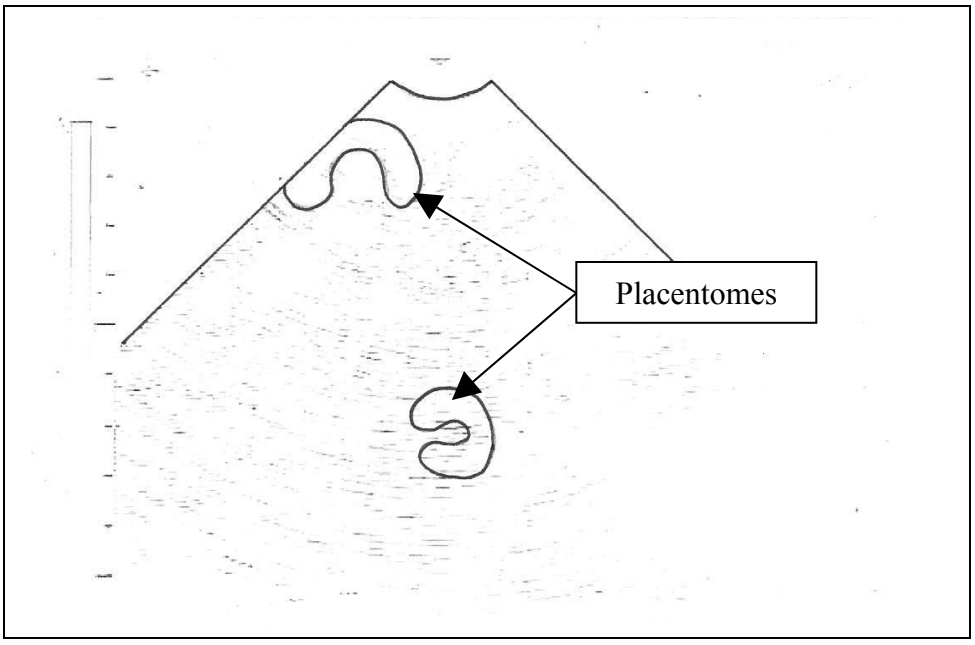
(A)



(B)

Figure 4.86: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 98 of gestation (late stage).Image (B) is a labeled image.

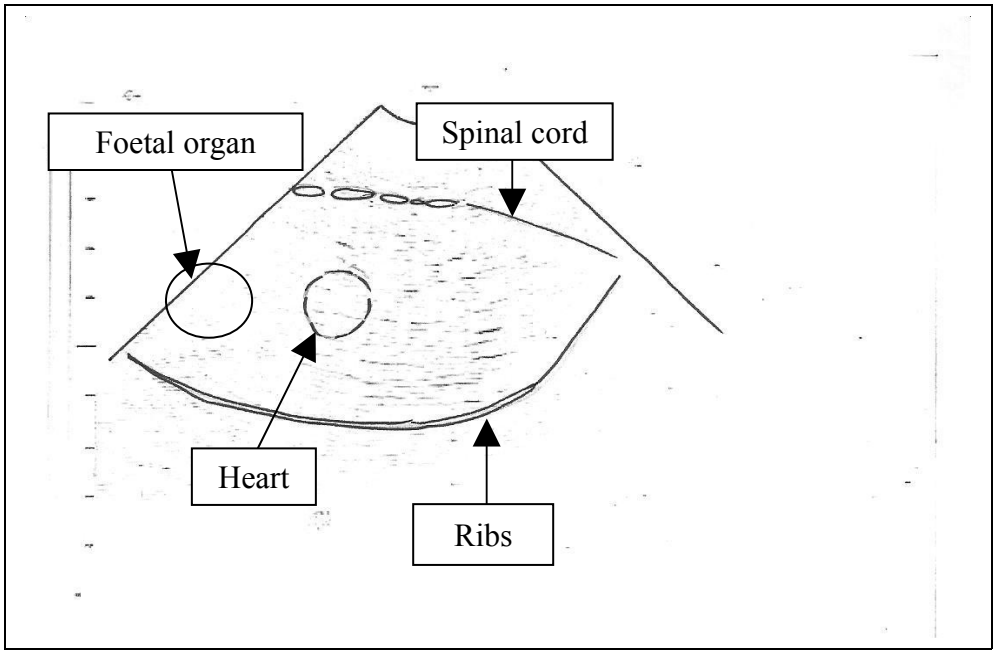
(A)



(B)

Figure 4.87 Image (A) is an original image. Placentomes were detected on day 98 of gestation (late stage).Image (B) is a labeled image.

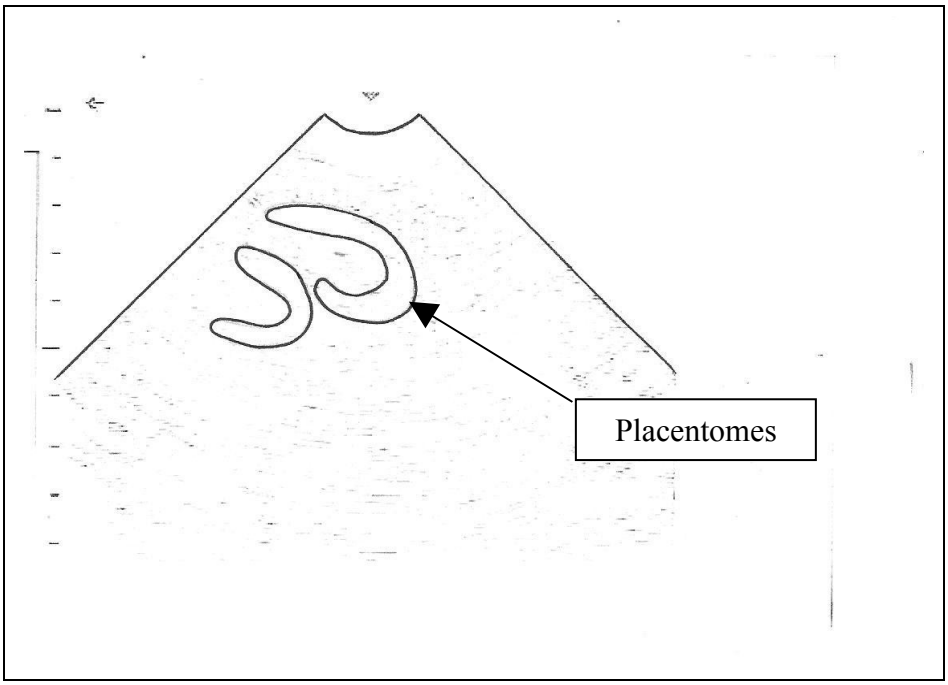
(A)



(B)

Figure 4.88 Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 109 of gestation (late stage).Image (B) is a labeled image.

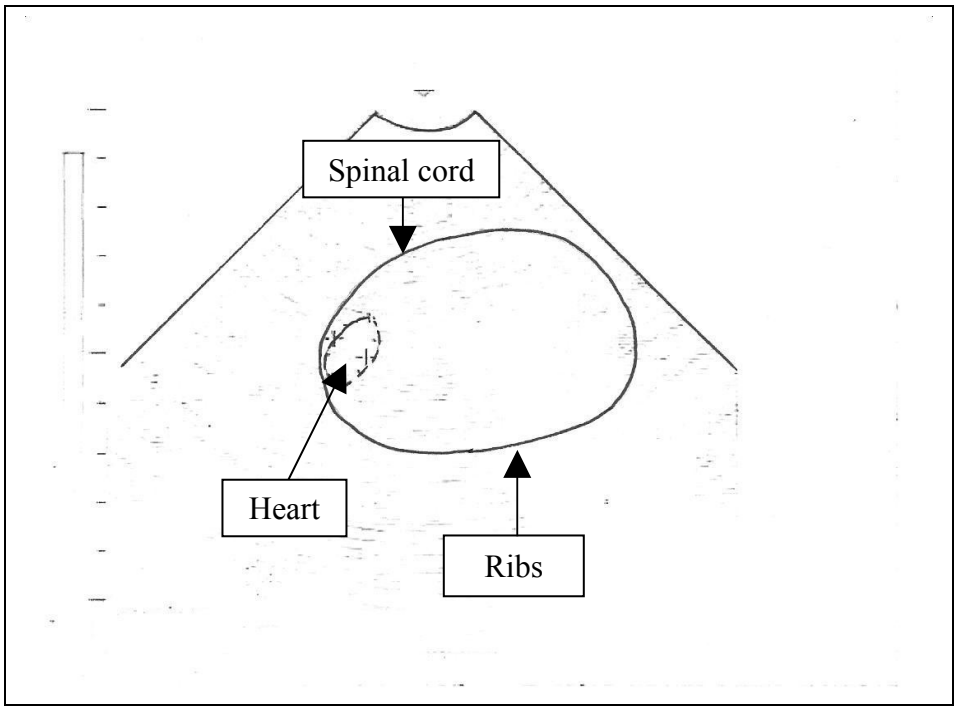
(A)



(B)

Figure 4.89: Image (A) is an original image. Placentomes were detected on day 109 of gestation (late stage).Image (B) is a labeled image.

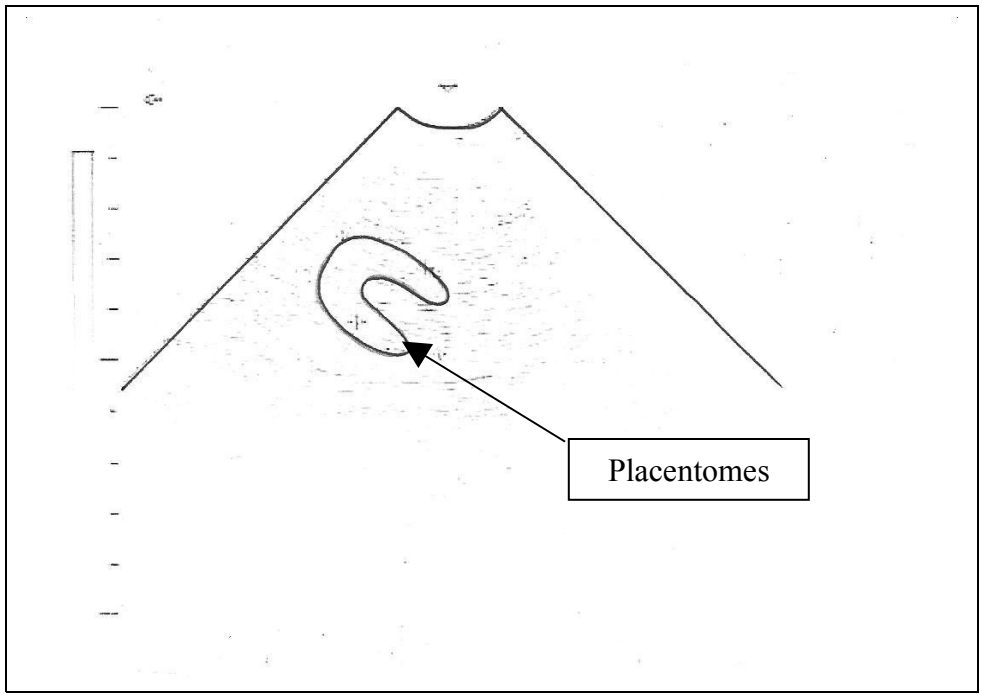
(A)



(B)

Figure 4.90: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 98 of gestation (late stage). Image (B) is a labeled image.

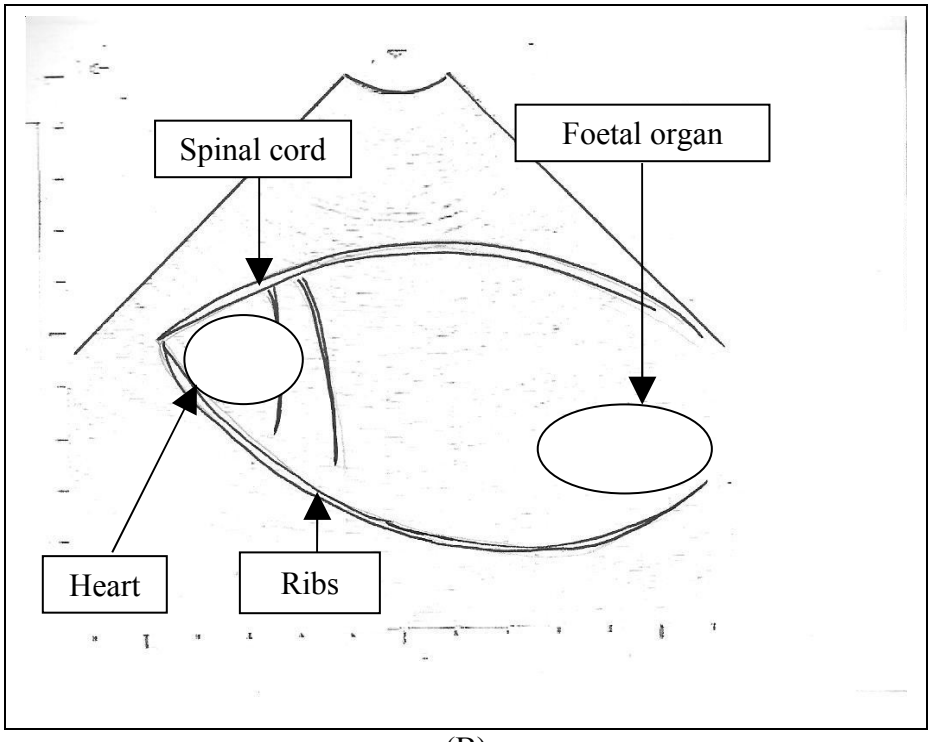
(A)



(B)

Figure 4.91: Image (A) is original image. Placentomes were detected on day 98 of gestation (late stage).Image (B) is labeled image.

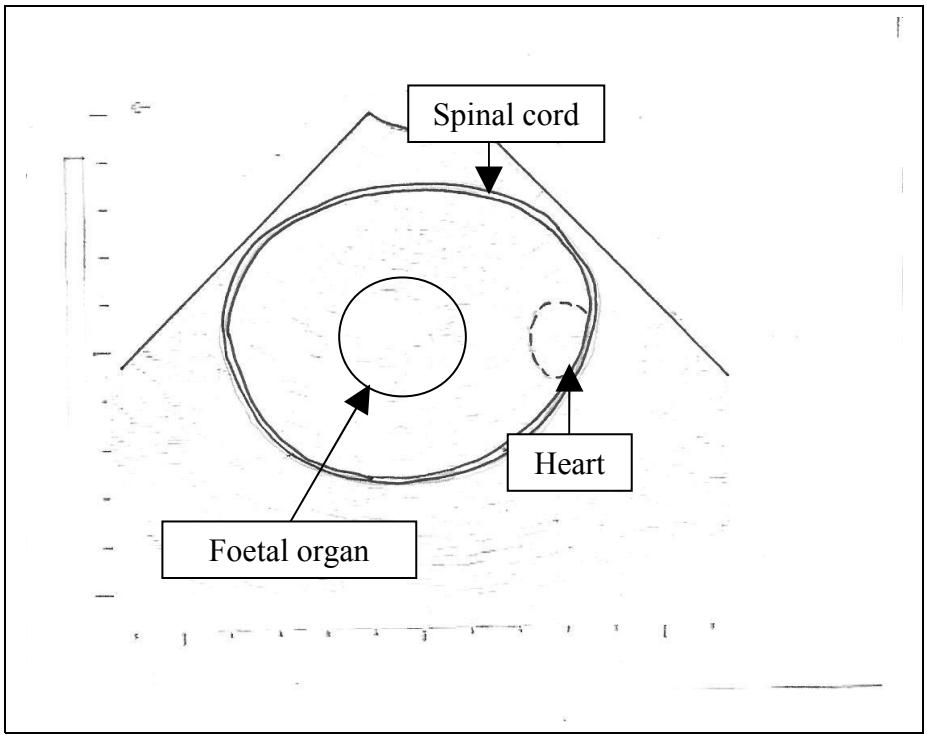
(A)



(B)

Figure 4.92: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 106 of gestation (late stage).Image (B) is a labeled image.

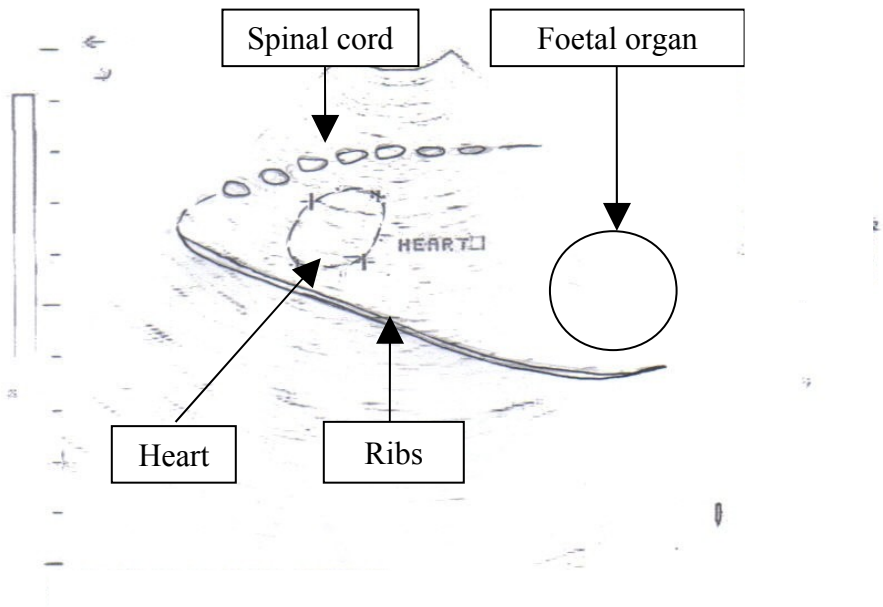
(A)



(B)

Figure 4.93: Image (A) is an original image. Foetus with heartbeat, spinal cord and foetal organ were detected on day 106 of gestation (late stage).Image (B) is a labeled image.

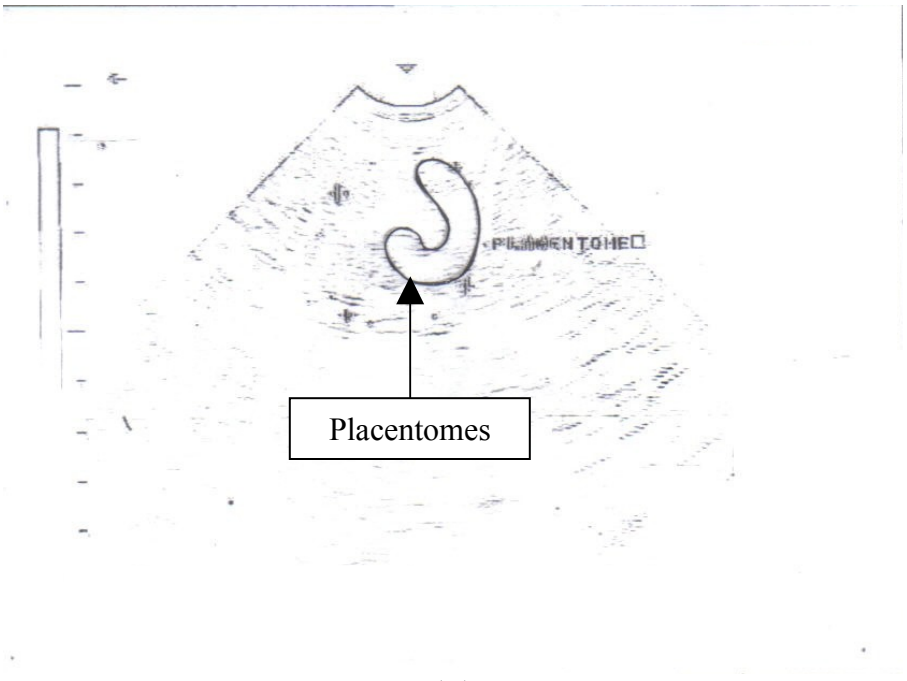
(A)



(B)

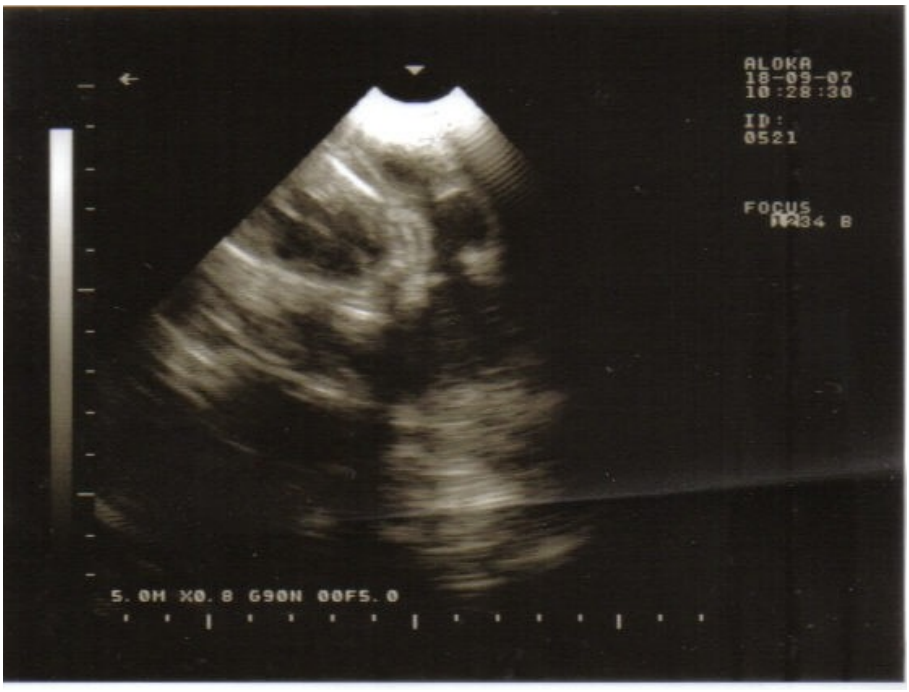
Figure 4.94: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 119 of gestation (late stage). Image (B) is a labeled image.

(A)

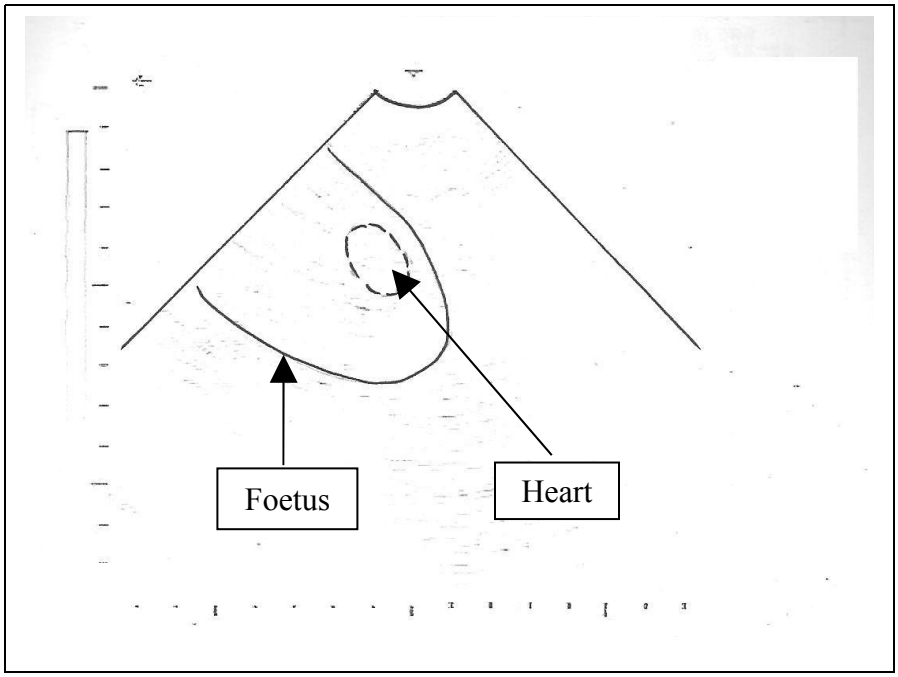


(B)

Figure 4.95: Image (A) is an original image. Placentomes were detected on day 119 of gestation (late stage).Image (B) is a labeled image.

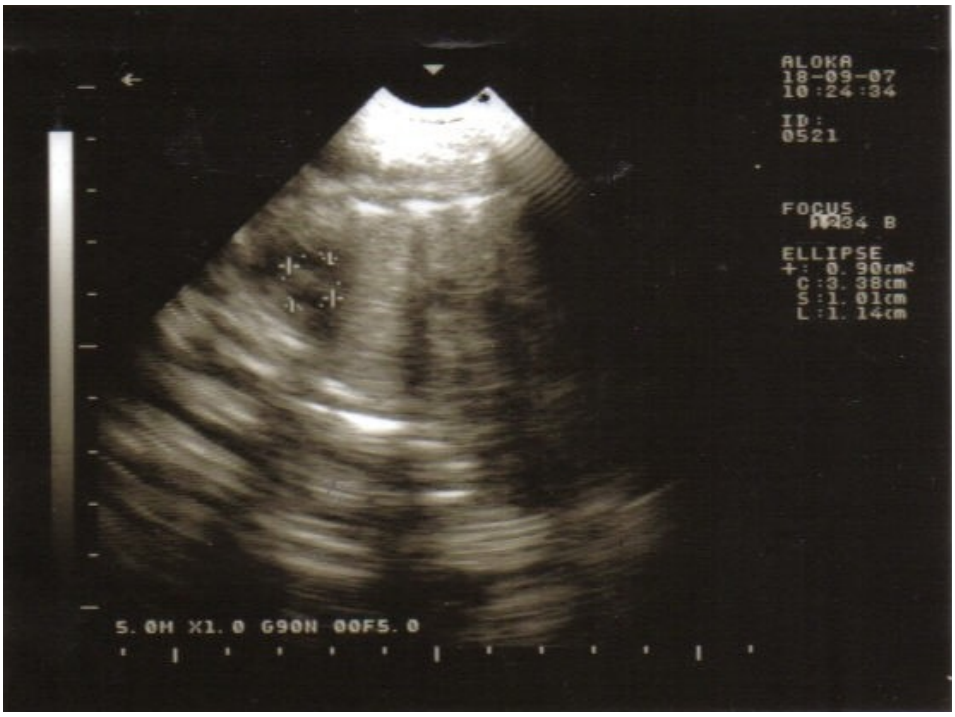


(A)

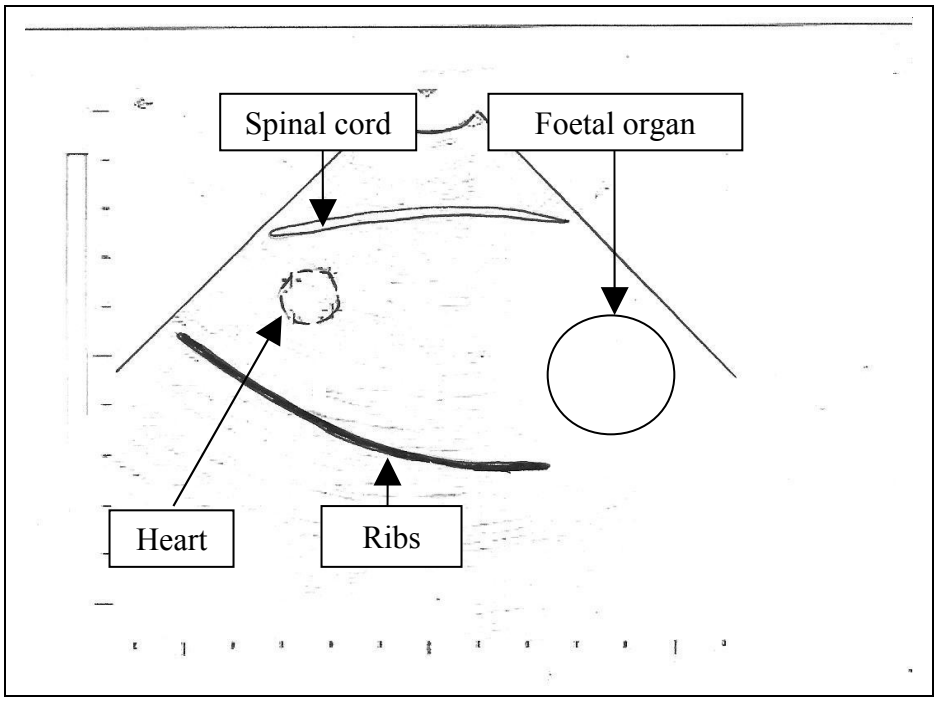


(B)

Figure 4.96: Image (A) is an original image. Foetus with heartbeat were detected on day 111 of gestation (late stage). Image (B) is a labeled image.

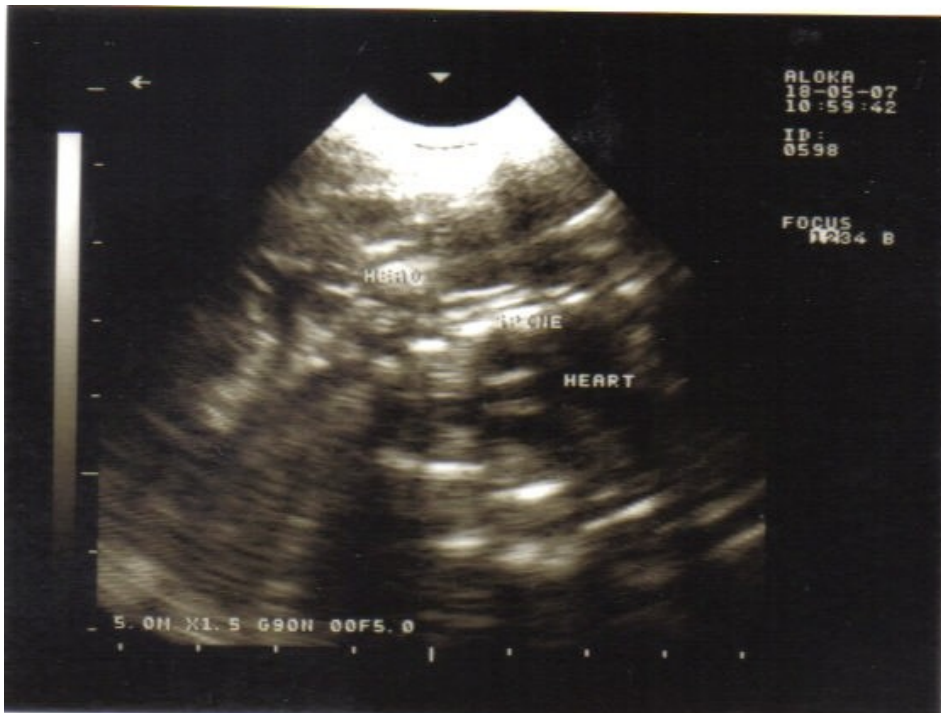


(A)

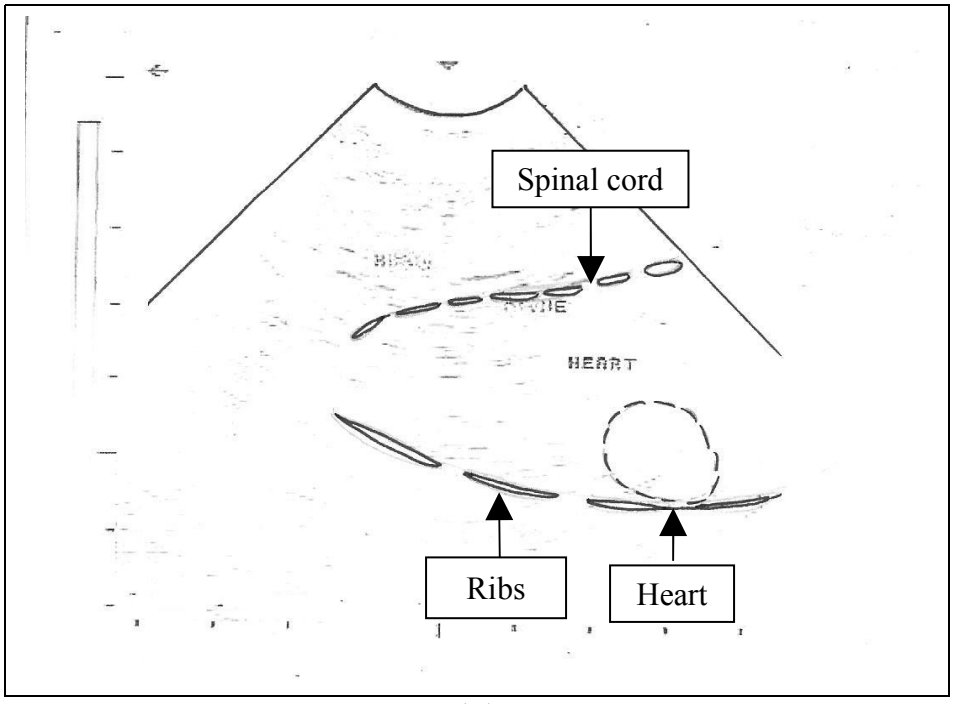


(B)

Figure 4.97: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 111 of gestation (late stage). Image (B) is a labeled image.

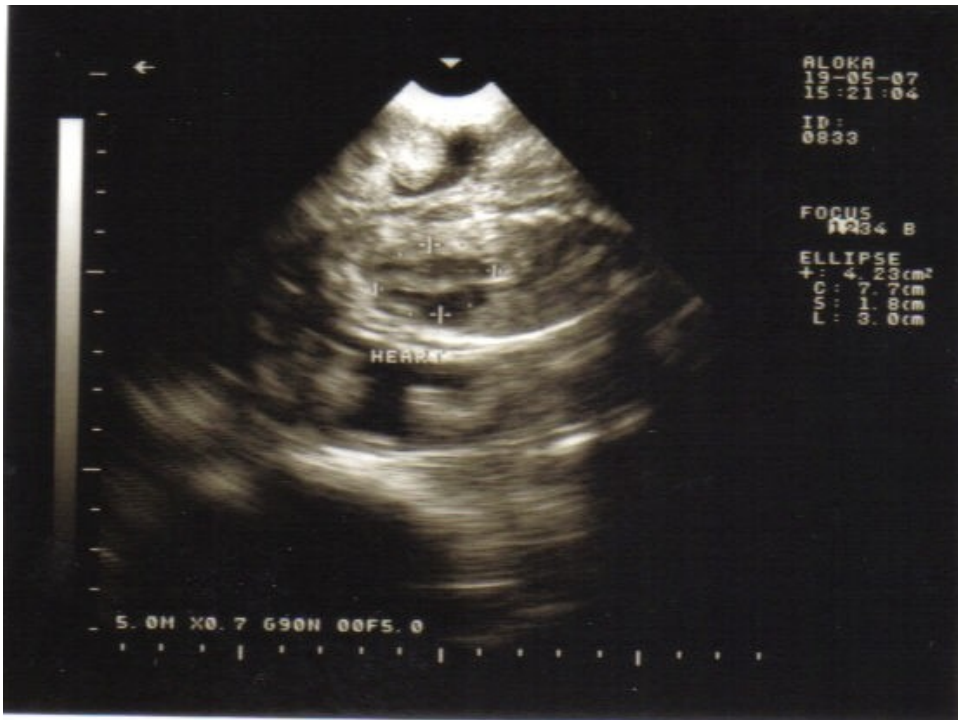


(A)

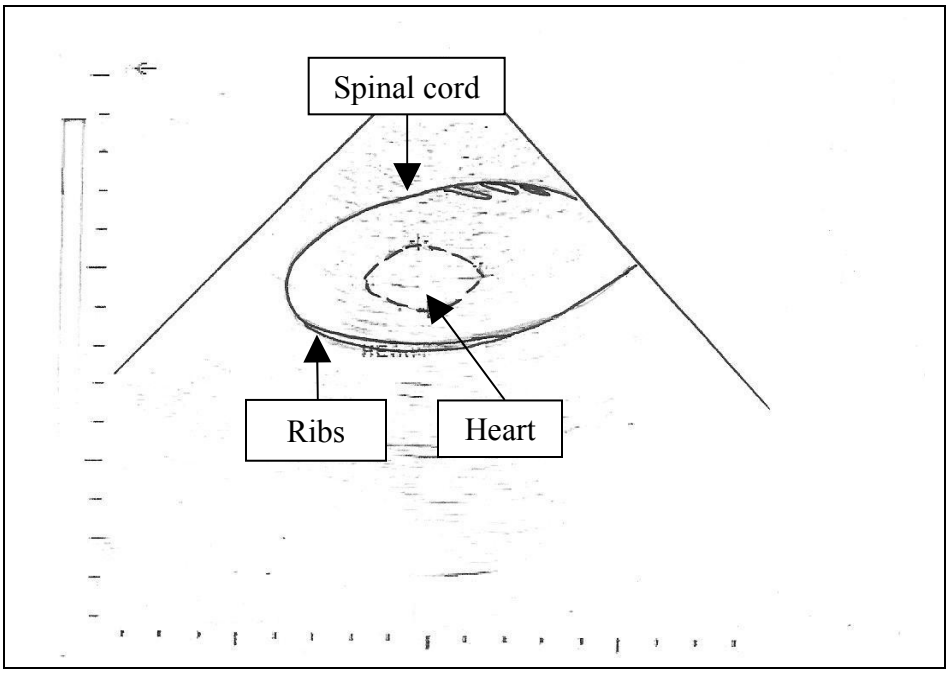


(B)

Figure 4.98: Image (A) is an original image. Foetus with heartbeat, spinal cord and ribs were detected on day 97 of gestation (late stage). Image (B) is a labeled image.



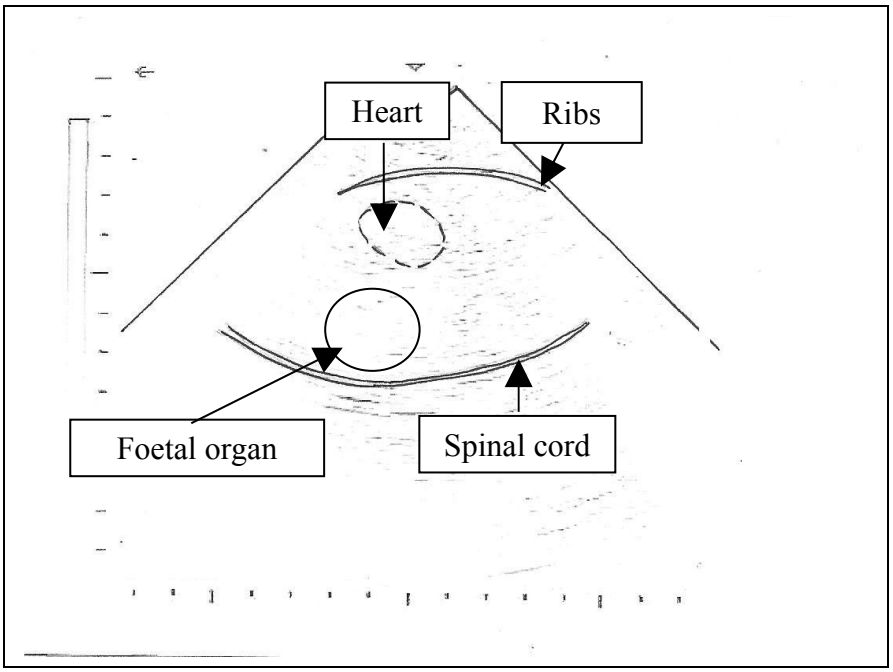
(A)



(B)

Figure 4.99: Image (A) is an original image. Foetus with heartbeat, spinal cord and ribs were detected on day 111 of gestation (late stage). Image (B) is a labeled image.

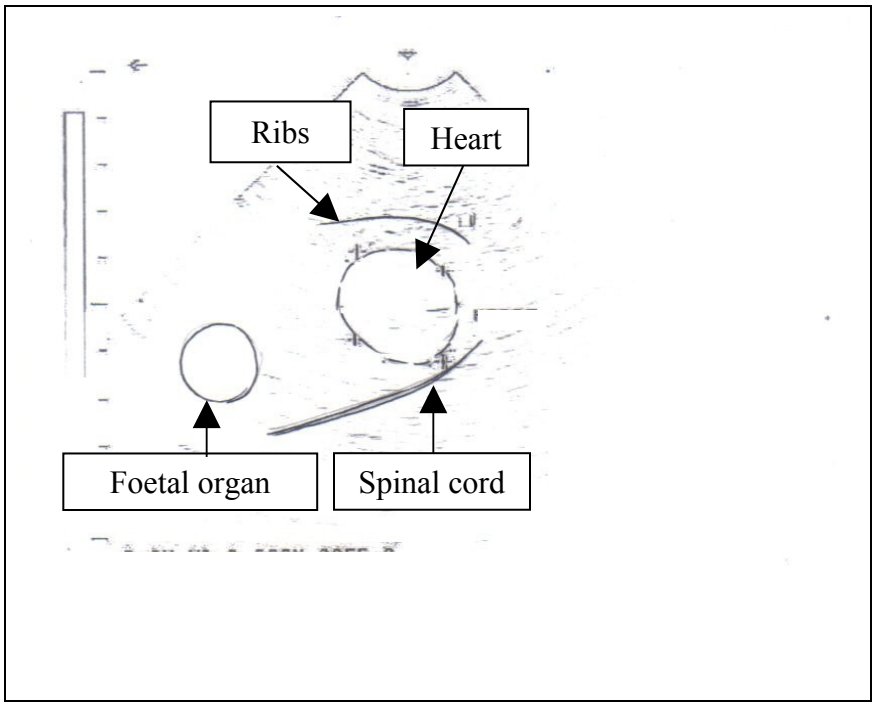
(A)



(B)

Figure 4.100: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 111 of gestation (late stage). Image (B) is a labeled image.

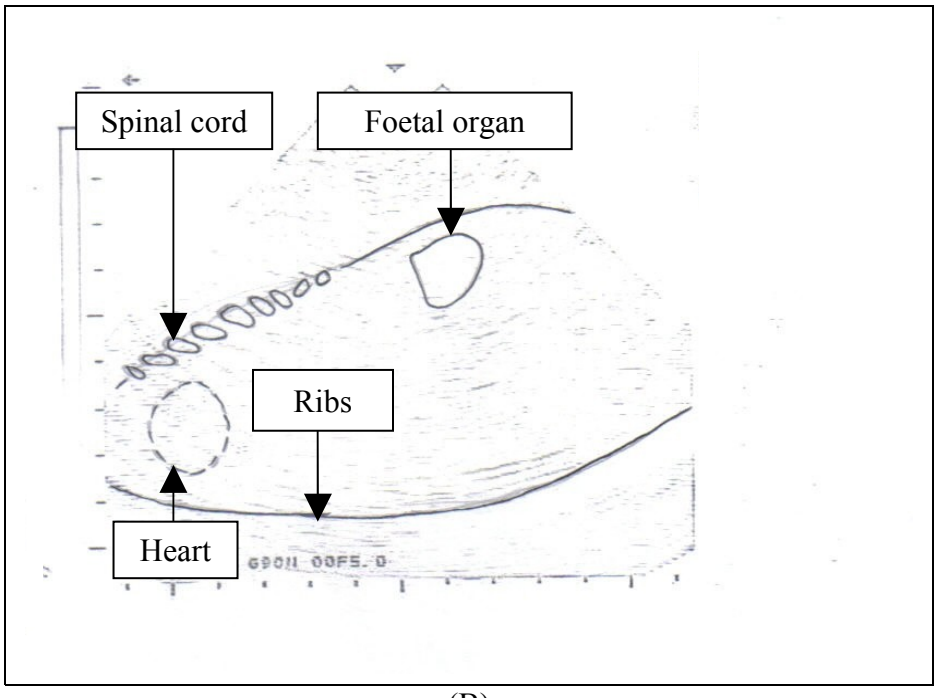
(A)



(B)

Figure 4.101: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 96 of gestation (late stage). Image (B) is a labeled image.

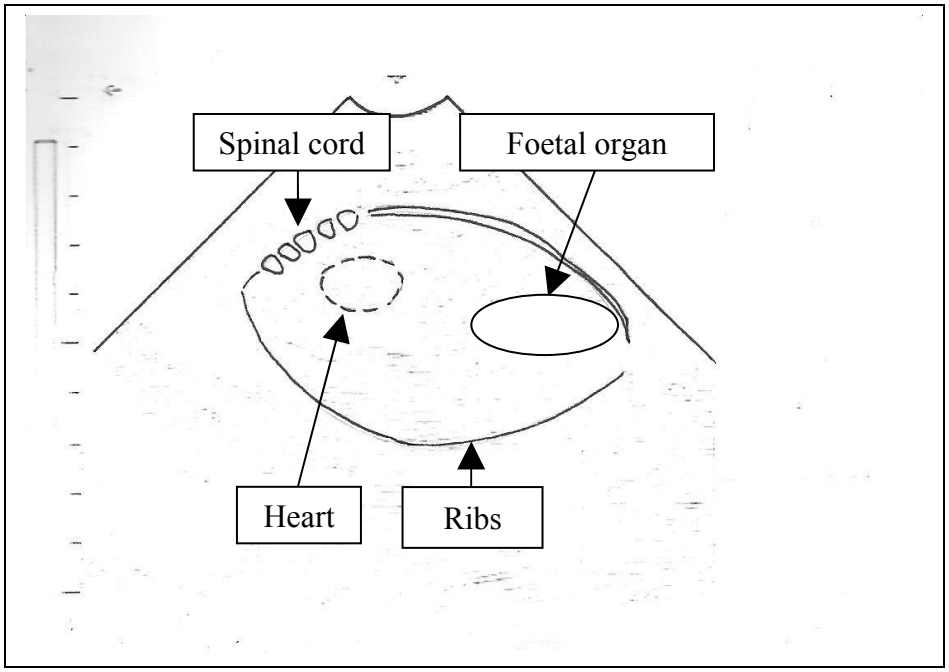
(A)



(B)

Figure 4.102: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 103 of gestation (late stage). Image (B) is a labeled image.

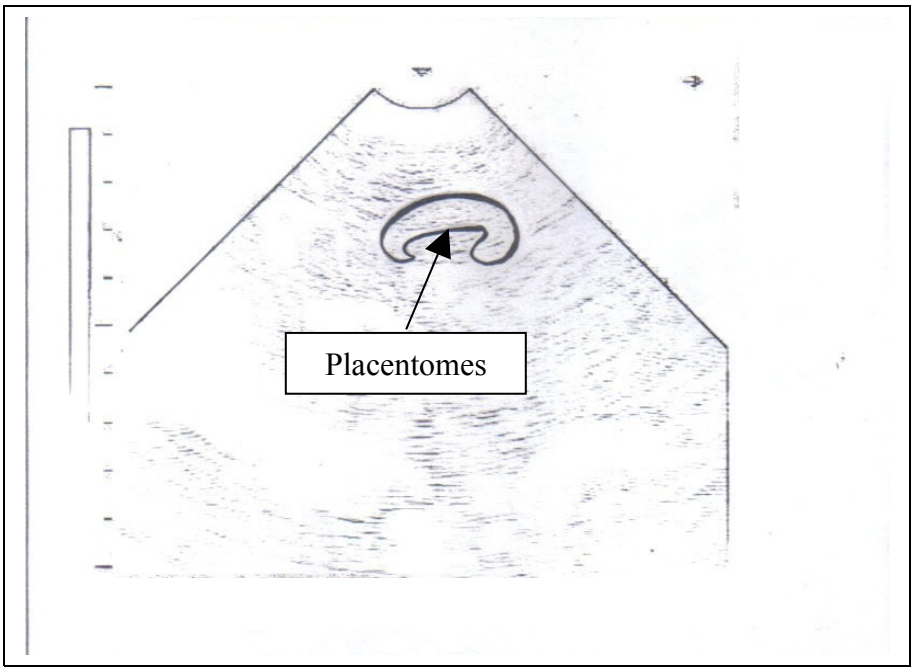
(A)



(B)

Figure 4.103: Image (A) is an original image. Foetus with heartbeat, spinal cord, ribs and foetal organ were detected on day 101 of gestation (late stage). Image (B) is a labeled image.

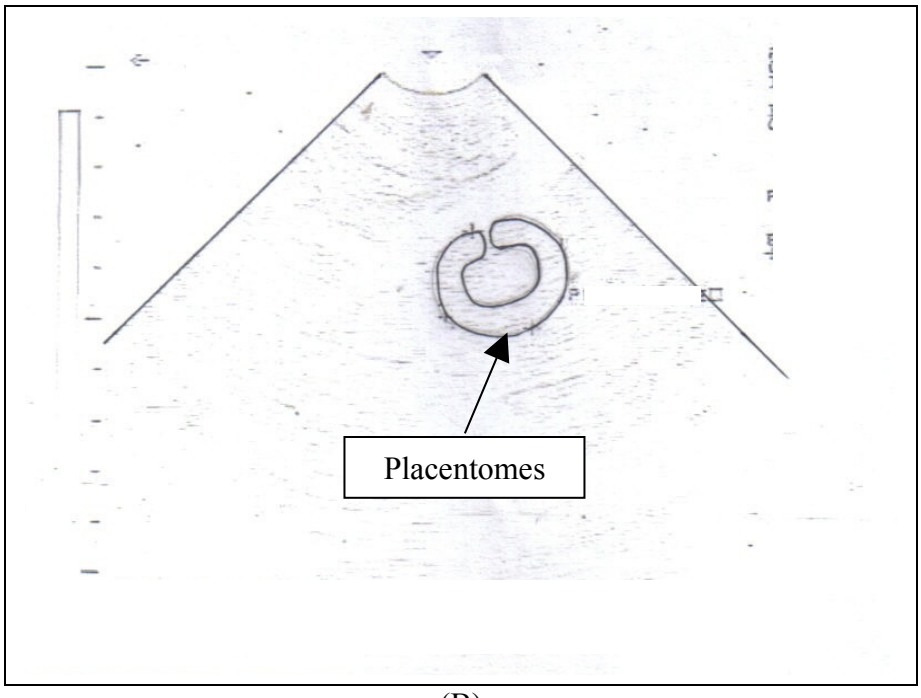
(A)



(B)

Figure 4.104: Image (A) is an original image. Placentomes were detected on day 137 of gestation (final stage). Image (B) is a labeled image.

(A)



(B)

Figure 4.105: Image (A) is an original image. Placentomes were detected on day 143 of gestation (final stage). Image (B) is a labeled image.

4.5 PREGNANCY DIAGNOSIS IN DOES UNDERGO NATURAL MATING AND AI WITH TRANSRECTAL AND TRANSABDOMINAL PROBE (EXPERIMENT 5)

In Experiment 5, a total of 75 does were used in the study. Table 4.14 shows prediction of specific and combinations of criteria obtained from Experiments 3 and 4 along pregnancy period. Specific and combinations of structures were initialized i.e. E1, E2 and etc, for easier arrangements. Table 4.15 shows summary on percentage of accuracy on pregnancy status and predicted day of gestation for 17 pregnant does using transrectal probe (based on kidding date). During early stage of pregnancy, a total of 13 and 4 does that undergo natural mating and AI were detected pregnant with combinations E1:sac (Figures 4.58-4.60), E2- non-echogenic (NE) area (Figures 4.61-4.63) and E3- foetus-uterine wall-amniotic fluid-heartbeat (Figures 4.64-4.67). Percent of accuracy for combinations of structures i.e. E1, E2 and E3 gave 100% on days 21-28, 21-28 and 29-45 of gestation, respectively. During middle stage of pregnancy, combinations of structures i.e. M1:foetus-heartbeat (Figure 4.68), M2-placentomes-foetus-heartbeat (Figures 4.69-4.78) an M3:foetus-heartbeat-spinal cord-ribs (Figures 4.79-4.81) gave percent accuracy of 100% on range of days 50-71 and 72-83 of gestation for 12 pregnant does (8 does that underwent natural mating and 4 does with AI). A total of 15 and 4 does that underwent natural mating and AI were detected pregnant with different combinations L1:placentomes-foetus-heartbeat-spinal cord-ribs (Figures 4.82-4.88), L3:placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ (Figures 4.89-4.100) and L4: foetus-heartbeat-spinal cord-ribs-foetal organ (Figures 4.101-4.106) during late stage of gestation. Combination of structures i.e. L1, L2 and L3 gave 100%, 80% and 100% accuracy from days 84 to 119 of gestation. Two does were misdiagnosed on range of days 104-119 with L3 combination. During final stage of pregnancy, a total of 3 and 1 does that underwent natural mating and AI were detected pregnant with detection of placentomes (F2) in Figures 107 and 108. Detection of placentomes gave 100% accuracy on pregnant status and age

prediction from days 121-146 of gestation. Figure 4.58 shows occurrence of significant indicators i.e. specific and combinations of structures along gestation period with transrectal and transabdominal probes. Structures on days 21-28 and 29-45 of gestation were sac (6 times) and non-echogenic (NE) area (5 times); and foetus-uterine wall-amniotic fluid-heartbeat (6 times), respectively. On days 60-71 of gestation, combinations of structures were foetus-heartbeat (thrice); placentomes-foetus-heartbeat (thrice) and foetus-heartbeat-spinal cord-ribs (once). On days 72-83 and 84-91 of gestation, combinations of structures were placentomes-foetus-heartbeat (4 times) and placentomes-foetus-heartbeat-spinal cord-ribs (3 times), respectively. Occurrences of combinations of structures detected on days 92-119 of gestation were 10 and 7 times for placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ and foetus-heartbeat-spinal cord-ribs-foetal organ. On days 120-147 of gestation, occurrence for placentomes was 8 times. Table 4.17 shows accuracy values (%) for each combination on pregnant status and days of gestation using different probes. During early stage of gestation, accuracy was 100% for all combinations (E1, E2 and E3) using transrectal probe. All combinations during middle and final stages gave 100% accuracy. Combination during late stage for L1, L3 and L4 were 100%, 80% and 100% that gave 97% overall accuracy.

Table 4.11: Pregnancy predictive value (%) on specific and combinations of structures along gestation period using both probes

Stage of pregnancy	Range of days (gestation days)	Specific/combination of structures	% prediction of stages of gestation [α]	Combination
Initial	16-20	Sac	25 (1/4)	E1
Early	21-28	Sac	44 (7/16)	E1
	21-28	Non-echogenic (NE) area	44 (7/16)	E2
	29-35	Foetus-uterine wall-amniotic fluid-heartbeat	83 (5/6)	E3
	36-45	Foetus-uterine wall-amniotic fluid-heartbeat	100 (5/5)	E3
Middle	60-71	Foetus-heartbeat	33 (4/12)	M1
		Placentomes-foetus-heartbeat	25 (3/12)	M2
		Foetus-heartbeat-spinal cord-ribs	25 (3/12)	M3
		Placentomes	17 (2/12)	M4
	72-83	Foetus x heartbeat	33 (3/9)	M1
		Placentomes-foetus-heartbeat	22 (2/9)	M2
		Foetus-heartbeat-spinal cord-ribs	22 (2/9)	M3
		Placentomes	22 (2/9)	M4
Late	84-91	Placentomes-foetus-heartbeat-spinal cord-ribs	25 (1/4)	L1
		Foetus-heartbeat-spinal cord-ribs	25 (1/4)	L2
	92-103	Placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ	40 (4/10)	L3
		Foetus-heartbeat-spinal cord-ribs-foetal organ	20 (2/10)	L4
	104-111	Placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ	60 (3/5)	L3
		Foetus-heartbeat-spinal cord-ribs-foetal organ	40 (2/5)	L4
	111-119	Placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ	33 (3/9)	L3
		Foetus-heartbeat-spinal cord-ribs-foetal organ	44 (4/9)	L4
Final	120-131	Placentomes-foetus-heartbeat-spinal cord-ribs-foetal organ	12.5 (1/8)	F1
	133-147	Placentomes	87.5 (7/8)	F2

[α] = number of does with specific structures upon total of doe during particular range of days

Table 4.12: Summary on percentage of predicted accuracy on pregnancy status and predicted day during early stage of gestation using 7.5 MHz transrectal probe

Combination	N	Prediction			Actual			Percent of accuracy (%)	
		Pregnant status	Range (day)	Stage of pregnancy	Pregnant status	Day[a]	Stage of pregnancy	Pregnant status	Day
E1	6	+	21-28	Early	+	21 [b]	Early	100	100
		+	21-28	Early	+	22	Early	100	100
		+	21-28	Early	+	24	Early	100	100
		+	21-28	Early	+	23	Early	100	100
		+	21-28	Early	+	25	Early	100	100
		+	21-28	Early	+	24	Early	100	100
E2	5	+	21-28	Early	+	21	Early	100	100
		+	21-28	Early	+	22 [b]	Early	100	100
		+	21-28	Early	+	23	Early	100	100
		+	21-28	Early	+	22	Early	100	100
		+	21-28	Early	+	21 [b]	Early	100	100
E3	6	+	29-45	Early	+	29	Early	100	100
		+	29-45	Early	+	33 [b]	Early	100	100
		+	29-45	Early	+	31	Early	100	100
		+	29-45	Early	+	30	Early	100	100
		+	29-45	Early	+	31	Early	100	100
		+	29-45	Early	+	36	Early	100	100
Total	17							100	100%

[a] = calculated retrospectively based on kidding date

[b] = does underwent artificial insemination

Note: Scanning prediction was done prior to kidding and percentage of accuracy was calculated accordingly

Table 4.13: Summary prediction and actual days of foetus with percent of accuracy on pregnancy status and predicted day during middle, late and final stages of gestation using 5.0 MHz transabdominal probe

Combination	N	Prediction			Actual			Percent of accuracy (%)	
		Pregnant status	Range (day)	Stage of pregnancy	Pregnant status	Day[a]	Stage of pregnancy	Pregnant status	Day
M1	3	+	50-71	Middle	+	51[b]	Middle	100	100
		+	50-71	Middle	+	53	Middle	100	100
		+	50-71	Middle	+	54	Middle	100	100
M2	7	+	50-71	Middle	+	60	Middle	100	100
		+	50-71	Middle	+	60	Middle	100	100
		+	50-71	Middle	+	65[b]	Middle	100	100
		+	72-83	Middle	+	75	Middle	100	100
		+	72-83	Middle	+	77[b]	Middle	100	100
		+	72-83	Middle	+	79	Middle	100	100
		+	72-83	Middle	+	82[b]	Middle	100	100
M3	2	+	50-71	Middle	+	70	Middle	100	100
		+	50-71	Middle	+	65	Middle	100	100
L1	3	+	84-91	Late	+	90[b]	Late	100	100
		+	84-91	Late	+	88	Late	100	100
		+	84-91	Late	+	91	Late	100	100
L3	9	+	92-111	Late	+	93	Late	100	100
		+	92-111	Late	+	95[b]	Late	100	100
		+	92-111	Late	+	98	Late	100	100
		+	104-119	Late	+	109	Late	100	100
		+	104-119	Late	+	95[b]	Late	100	0[c]
		+	104-119	Late	+	106	Late	100	100
		+	104-119	Late	+	98	Late	100	0[c]
		+	104-119	Late	+	119	Late	100	100
		+	104-119	Late	+	105	Late	100	100

(continued)

Combination	N	Prediction			Actual			Percent of a (continued)	
		Pregnant		Stage of	Pregnant		Stage of	Pregnant	Day

		status	Range (day)	pregnancy	status	Day[a]	pregnancy	status	
		+	104-119	Late	+	111	Late	100	100
L4	7	+	92-111	Late	+	97	Late	100	100
		+	92-111	Late	+	108	Late	100	100
		+	92-111	Late	+	96 [b]	Late	100	100
		+	92-111	Late	+	103	Late	100	100
		+	92-111	Late	+	105	Late	100	100
		+	92-111	Late	+	95	Late	100	100
F2	4	+	121-146	Final	+	137 [b]	Final	100	100
		+	121-146	Final	+	143	Final	100	100
		+	121-146	Final	+	125	Final	100	100
		+	121-146	Final	+	141	Final	100	100

[a] = calculated retrospectively based on kidding date

[b]= does underwent artificial insemination

[c] = 0% could be due to normal variation ± 7 day of gestation length

Note: Scanning prediction was done prior to kidding and percentage of accuracy was calculated accordingly

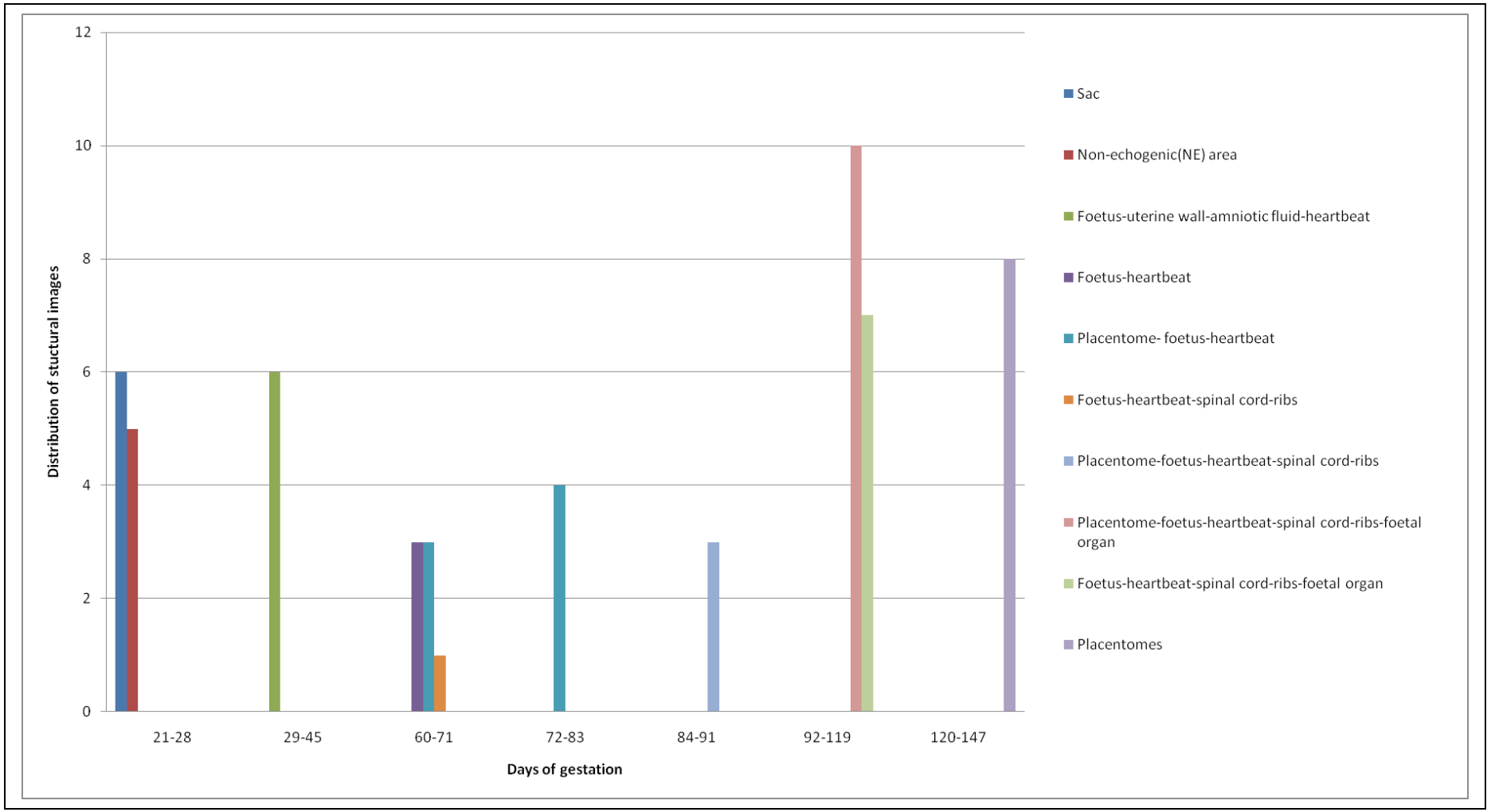


Figure 4.56: Distribution of significant indicators along gestation period with transrectal and transabdominal probes

Table 4.14: Accuracy value (%) on stages of pregnancy during early, middle, late and final stage of gestation

Stages of gestation	Early stage n=17				Middle stage n=12				Late stage n=20				Final stage n=4	
	Transrectal probe				Transabdominal				Transabdominal				Transabdominal	
Combinations of indicators	E1	E2	E3	Overall (%)	M1	M2	M3	Overall (%)	L1	L3	L4	Overall (%)	F1	Overall (%)
Percent accuracy of pregnancy status (positive diagnosis/ total of doe)	100 (6/6)	100 (5/5)	100 (6/6)	100	100 (3/3)	100 (7/7)	100 (2/2)	100	100 (3/3)	100 (10/10)	100 (7/7)	100	100 (4/4)	100
Percent accuracy of days of gestation (positive diagnosis/ total of doe)	100 (6/6)	100 (5/5)	100 (6/6)	100	100 (3/3)	100 (7/7)	100 (2/2)	100	100 (3/3)	80[a] (8/10)	100 (7/7)	93	100 (4/4)	100
Overall accuracy for each stage (%) (total does)	100(17)				100(12)				97(20)				100(4/4)	

[a] Similarity of combinations of structures detected with middle stage of gestation lead to misdiagnosed. Therefore two does were wrongly concluded as late stage.