Feliks NAGÓRSKI & Kazimierz GRODZKI

THE ELECTROCARDIOGRAM OF EUROPEAN BISON DURING EXPERIMENTAL DEATH

ELEKTROKARDIOGRAM UMIERAJĄCEGO SERCA ŻUBRA W WARUNKACH ŚMIERCI DOŚWIADCZALNEJ

Bisoniana XXIX

The heart death was studied electrocardiographically in three European bisons, 4, 6 and 14 years old. During fast blood loss there was a reflex acceleration of heart action as a reaction to rapidly decreasing arterial pressure. Symptoms of hypoxaemia of the heart muscle and slowing of heart action were observed after the loss of $^3/_4$ of the blood. During the cessation of heart function the place of generating stimuli (starter) was changed and atrioventicular blocks appeared. The sinus rhytmus was changing gradually into node rhytmus. It was occasionally accompanied by atrioventricular extrasystoles. After clinical death heart action remained for variable time (from 30 sec to 3 minutes). During this period single sinusal or atrioventricular cycles were recorded. Ventricular flatter was never observed.

The mechanism of heart death has been studied for many years (Landendorf, 1897; Kuliabko, 1902; Pick, 1924; Smirnov, 1941) but this problem is still of considerable interest (Fogelson, 1957; Janiak, 1957 and others). The purpose of these investigations was to determine the sequence of disappearance of functions in different parts of the heart and to asses the possibility of reviving the heart after its clinical death. Dogs were used in most of the studies. Some observations were also made on humans. Large and free-living animals comparable to the European bison were not studied.

This communication presents results of electrocardiographic studies of the dying heart of European bisons subjected to experimental death by anesthetising and gradual bleeding. Three male bisons were used: »Putar« (6 years old, pedigree book No 1026), »Plamiec« (14 years old, pedigree book No 789) and »Puck« (4 years old, pedigree book No 1131).

It was found that the process of heart dying was very similar in all three cases and differed only in the final stage.

Reflex acceleration of heart action occured during fast blood loss as a reaction to decreasing arterial pressure. Large loss of blood was causing hypoxaemia of the heart muscle, symptoms of coronary insufficiency and disorders of the heart rhytmus. In the next stage i.e. during cessation of heart functions the place of generating the stimuli starter (Kowarzyk) moved and partial blocks occured indicating disorders in heart conduction. The sinus rhytmus was changing gradually into node rhytmus. Occasionally it was accompanied by arterioventricular extrasystoles (for example in »Puck«).

[Acta theriol., 12, 32: 463, 1967]

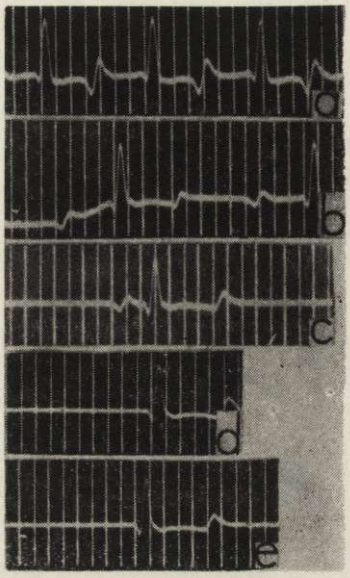

Fig. 1.

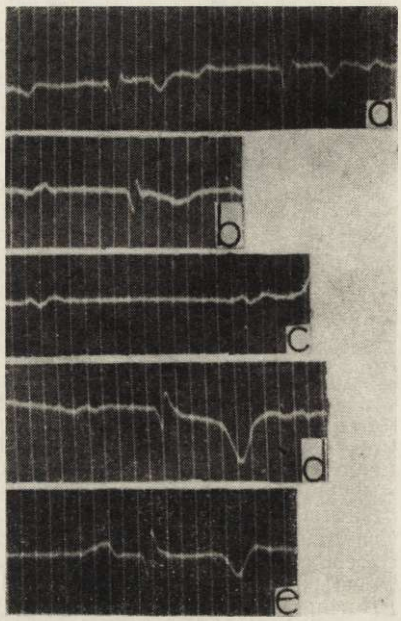

Fig. 2.

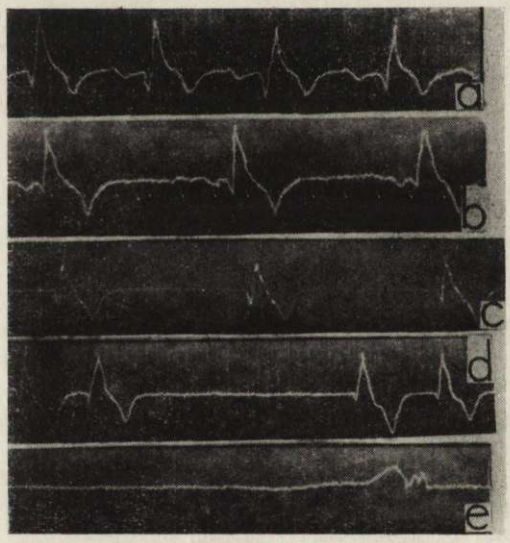

Fig. 3.

Fig. 1. The electrocardiogram of 6 year old European bison »Putar«.
a) After issue of 7 liters of blood in 6 minutes; sinus rhytmus 166/min; wave *P* completely overlaps wave *T*. b) After issue of 12 l of blood; sinus rhytmus 86/min. c) Agony; movement of starter (K o w a r z y k) to the lower centers of the conduction system (*PQ* = 0.12 sec). d) Node rhytmus. e) After clinical death — slow node rhytmus.

⟶

After clinical death, heart function did not stop and was observed for various periods of time in individual bisons (from 30 sec to 3 min). In this period only single cycles were recorded. They were of sinusal, arterioventricular or ventricular origin (in »Plamiec«, »Putar« and »Puck«, respectively) the latter case with markedly changed ventricular complex. In one European bison (»Puck«) there were single extrasystoles but ventricular flatter during the process of heart death was never observed in contrary tc the findings in dogs (Janiak, 1957) and in humans (Hering, 1917). It could have been due to specific conditions of the heart death or else to peculiar characteristics of the heart of the European bison. This could be elucitated only by further studies.

Separate stages of heart death were recorded in the enclosed electrocardiographic figures 1—3.

REFERENCES

Fogelson L. I., 1957: Kliničeskaja elektrokardiografija. Moskwa. Hering H. E., 1917: Der Sekundenherztod mit besonderer Berücksichtigung des Herzkammerflimers (acc. to Fogelson). Janiak T., 1957: Über den Einfluss grosser fraktonierter Aderlasse durch Herzpunktion auf das Elektrokardiogramm des Hundes. Arch. Exp. Vet. Met., *11*: 386—401. Lipsk. Kuliabko A. A., 1902: Opyty ozivlenia serdca. Izv. AN SSSR, *16*: 175 (acc. to Fogelson). Langendorf O., 1897: Untersuchungen am überlebenden Säugetierherz. Pflügers. Arch., *66*: 355 (acc. to Fogelson, 1957). Pick E. P., 1924: Über das *primum* und *ultimum moriens* im Herzen. Klin. Wschr., *3*: 662. Smirnov A. I., 1941: O terminalnoj dejatelnosti serdca. Fiziol., *30*: 504.

Received, February 24, 1967.

Dept. Intern. Diseases, Warsaw Agric. Univ., Warszawa, Grochowska 272.

Fig. 2. The electrocardiogram of 14 year old bison »Plamiec«.
a) After issue of 12 l of blood in 30 min; sinus rhytmus 100/min. b) After issue of 19 l in 42 min; sinus rhytmus 80/min; disorders in the conduction atrium-ventricle of the type of Wenkebach periodic with gradual elongation of *P—Q* (from 0.20 min to 0.35 min) symptoms of coronary insufficiency. c) Atrioventricular block. d) Agony; severe symptoms of coronary insufficiency. e) 80 sec after clinical death — single sinusal cycles.

Fig. 3. The electrocardiogram of 4 year old European bison »Puck«.
a) After issue of 4 l of blood; sinus rhytmus 136/min; symptoms of disorders in interventricular conduction and coronary insufficiency. b) After the issue of 5 l of blood; movement of starter (Kowarzyk); extrasinual rhytmus 86/min. c) Node rhytmus 63/min; symptoms of coronary insufficiency increase (deep T). d) Agony; atrioventricular extrasystoles (*rythmus bigeminus*) 36/min. e) Three minutes after clinical death; deformed ventricular complexes — rhytmus 19/min.