

Brief Communication

AN EXPERIMENTAL APPROACH TO THE PORCINE STRESS SYNDROME*

A number of pigs die suddenly during transport and slaughter handling in a clinical picture which indicates that cardiac failure may be involved. At necropsy hemorrhages and ulcerations are demonstrated in the fundus mucosa of the stomach and subepicardial hemorrhages in the heart. *Tournut et al.* (1966) found that gastric ulcerations can develop during transport; *Lendfers* (1971) showed that the mortality during transport and slaughter handling could be reduced by sedatives. Physical and/or mental stress seem to be involved. The aim of the present study was to investigate whether mental stress can produce cardiac and gastric lesions in pigs.

Eleven crossbred pigs of Yorkshire and Swedish Landrace (body weight 85—90 kg) of both sexes were used. Stress was induced by restraint; that is, by the prevention of escape behaviour.

After an acclimatization period of 10—15 min. succinylcholinechloride (0.14 mg per kg b. wt.) was injected i.v. for 25—30 min. Gross muscle relaxation was achieved with respiratory activity maintained, then the relaxed animals were stimulated by an electrical animal pusher with 5—6 impulses of 5 sec. each. ECG was recorded during the acclimatization period as well as continuously during the experimental period. The animals were slaughtered 24—48 hrs. after the experiment, and necropsied immediately; tissue samples were taken from the heart and stomach for light microscopic and electron microscopic examination.

One of the pigs, which died ½ hr. after the experimental period, showed dyspnea and cyanosis. Another pig, which died during the stimulation period, developed sinus bradycardia, sinus arrest and ventricular fibrillation. The animals which survived

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had cardiac arrhythmias, such as sinus bradycardia and ventricular tachycardia. The T-wave changes included transitory and persistent lifting of the ST-segment in combination with T-negativity. Persistent T-negativity was seen in all animals by the end of the experiment.

At necropsy of the 2 pigs which died in connection with the experiment, multiple subendocardial and subepicardial hemorrhages were observed. Coarse tigroid pale areas were found in the left ventricle, mainly in the papillary muscles. Similar hemorrhages were found in the 9 slaughtered pigs and, in 5 of them macroscopical pale areas as well.

Light microscopy of the ventricular myocardium revealed degenerative foci of various sizes which were found in all animals. The myofibrils showed loss of cross-striation, segmentation, granular disintegration and lysis (Fig. 1). Proliferation of histiocytes and fibroblasts was also observed (*Johansson et al.* in press). Cryostat sections showed focal decreases of succinic dehydrogenase, lactic dehydrogenase, DPN-diaphorase and cytochrome oxidase. The ultrastructural changes were similar to those observed in studies on catecholamine effects in laboratory animals by other investigators. There was a varying degree of myofibrillar degeneration, swollen mitochondria with dense bodies and dilated sarcoplasmic reticulum (*Jönsson et al.* in press).

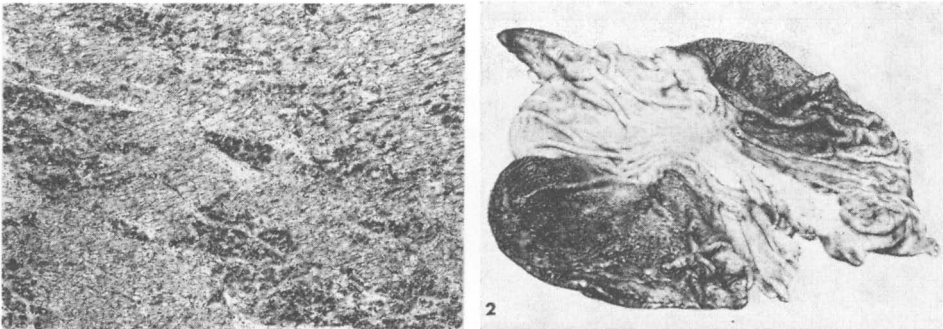


Figure 1. Left ventricular myocardium from a pig slaughtered 24 hrs. after restraint stress. Multiple small and large foci of necrotic muscle fibers are demonstrated (dark). Proliferation of mononuclear cells is evident. Goldner's trichrome, $\times 25$.

Figure 2. Stomach from a pig slaughtered 24 hrs. after restraint stress. Extensive hemorrhages and erosions are observed in the fundus mucosa.

Macroscopical lesions in the stomach were found in all experimental animals. The lesions were mainly hemorrhages and erosions of the glandular epithelium in the fundus region, particularly along the *curvatura major* (Fig. 2). In several cases the gastric ingesta was dark because of the hemorrhaging. At microscopical examination hemorrhages and focal superficial necroses of the epithelium were observed. These necrotic foci were demarcated by a zone of inflammatory reaction.

It is concluded that the myocardium and the stomach of pigs are sensitive to stress conditions. Lesions of these organs seem to be part of the porcine stress syndrome. Studies of this syndrome under slaughter conditions are under progress.

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