

Muscular Degeneration Produced by Experimental Transport Stress in Pigs

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MUSCULAR DEGENERATION is a pathological finding widespread in pigs. The most numerous reports on muscle degeneration are connected with a disease called transport muscle dystrophy, which occurs after transport or after transport and slaughter. Animals that seem healthy on the farm may die suddenly during transport or shortly thereafter. In other cases change may be observed in the meat of slaughtered animals. Post-mortal changes in the muscle include pallor, edema, hemorrhage, and softening. The cut surface of affected muscle displays a marked moistness. The microscopic picture is characterized by fragmentation of muscle fibers, dissolution of myofibrils and sarcoplasm, disappearance of striation, separation of endomysium, and massive edema. The changes in the muscle are considered to be the result of muscle glycogen breaking down to lactic acid, which in turn lowers pH below 6.2. This acid condition is believed to bring about denaturing of protein. An associated lowered electrical resistance may be a more important factor.

The purpose of this experiment is to ascertain if muscle degeneration can be regularly produced in healthy pigs of slaughter weight (180-225 pounds) under laboratory conditions and to determine the associated clinical manifestations.

Materials and Methods

The experimental pigs belong to the Swedish Landrace or a mixture of this race with the English Large White Breed. The animals fall within the 180-225 pound weight range. Both females and castrated males are represented. Prior to the experiment the animals were examined. Their health was controlled by the veterinary surgeons of the staff of the Royal Veterinary College, Stockholm, and the animals were found to be free of disease. Before and during experimentation they were kept in separate group quarters.

Methods

The animals were placed within a special transport-simulating pen that was mounted on a horizontal, roughened rail course. The pen was coupled

calm the animals. All the plasma enzyme findings obtained fell within the normal range. Biopsies of longissimus dorsi taken under trichloroethylene narcosis appeared microscopically to be healthy reddish muscle with a firm consistency. The histological picture was that of normal muscle.

After 24 hours' rest the animals were shaken for four hours in the electrically driven and heated transport-simulating pen as described in Methods. Upon removal from the machine all animals appeared apathetic. They preferred to lie and showed locomotive disturbances. When forced to rise, they stood with arched backs. When forced to move, atony was observed. They also displayed tachycardia and tachypnea. All of the GOT values

TABLE 1

No.	"GOT"			"OCT"			Micro- scopic	Micro- scopic	Degree of Muscle Degen- eration and Remarks
	PP	S	SS	P	S	SS			
65	39	69					*	+++	
66	47.5	100.5					*	++++	
68	37	57					*	++	
69	35.5	119.5					*	++++	
70	34	74					*	+++	
72	41.5	149.5					*	++++	
76	49.5	75					*	+++	
77	45	58.5					*	+++	
2001	---	74					*	+++	
2002	---	72					*	+++	
2036	14	67			1.5		*	+++	
2004	18	64			4.5		*	+++	
2008	35	48		3	1.5		*		tech. fault with slide
2028	15	103		0.5	2.0		*		tech. fault with slide
3006	14	74					*		tech. fault with slide
5079	14	60	28	10.9	3.3	1.7	*		
5076	16	87	34.5	2.2	0	2.2	*		
5004	16	87	31	6.9	5.5	2.7	*		
5022	16	51	31	0.5	2.2	2.2	*		
6018	15.5	26.5	14.5	1.1	4.4	3.3			
6006	25	25	19	1.7	4.4	3.8			
6004	21.5	23	18.5	2.2	3.3	0.5			
6026	19	33	25	2.2	2.2	0			

* Appeared microscopically after 4 hours in moist air noticeably softer in consistency, gray-white in color and moist on the cut surface.

+ Minimum histological muscle degeneration.

++ More than minimal muscle degeneration.

+++ Muscle degeneration histologically observed.

++++ Marked muscle degeneration histologically observed.

P Control findings.

S Stress findings.

SS Findings 24 hours after stress.

except one were elevated by the experiment. Sixty per cent of these passed into the pathological category. The OCT values showed no significant change and in all cases remained within the normal limits. This indicates that the changes that occurred in the stressed animals were in their skeletal muscle masses and not in their livers. Microscopic inspection of the biopsies after standing in moist air for four hours showed them to be noticeably softer in consistency and more gray-white in color than normal muscle similarly exposed. They had a markedly moister cut surface following biopsy. All microscopic slides, fixed as described in Methods, showed muscle degeneration to some extent. Good agreement was found between the histological examination and the plasma GOT findings. When one was normal the other was also, as in the control tests. When the GOT findings were pathologically elevated, the histological findings were correspondingly more marked in their degeneration.

Twenty-four hours after stress, blood was drawn again from eight animals. The GOT and OCT findings in the tests fell within the normal range and relatively close to the control findings.

Conclusions

Some muscle degeneration can be regularly produced in healthy pigs of slaughter weight by four hours of simulated transport shaking at 34°C.

The clinical manifestations are:

1. Plasma GOT findings elevated compared with those taken prior to transport stress.
2. Plasma OCT levels remain within normal range indicating seat of tissue destruction to be in the skeletal muscle masses and not in the liver.
3. After allowing all biopsy specimens to stand in moist air for four hours, histological examination shows definite muscle degeneration after transport stress as compared with control biopsies taken prior to the stressing.
4. A direct relationship exists between extent of muscle degeneration and rise in plasma GOT.
5. Plasma GOT levels return to within normal limits after a 24-hour recovery period in living pigs.

Literature Cited

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