An Experimental Study of Normothermic Abdominal Aorta Clamping in Dogs: I. The Safe Time Limit and Syndromes after Abdominal Aorta Clamping

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Summary: The results of our study show that 25 min are the safe time limit for abdominal aorta clamping in dogs. Beyond this time limit there is a great tendency to produce severe changes in hemodynamics, blood biochemistry and ultrastructure of organs, leading to a series of syndromes, such as, respiratory distress, acute hypertensive cerebral edema, multi-organ microthrombosis – diseased cell – syndrome.

Key words: aorta, vasoclamping, respiratory distress, cerebral edema, multi-organ microthrombosis – diseased cell – syndrome

Abdominal aortic vasoclamping is efficacious for severe abdominal hemorrhage caused by trauma or during operation, but no report regarding its side-effects has been available. We performed normothermic abdominal aortic clamping in dogs, and the pathophysiological changes and the safe time limit were studied.

MATERIALS AND METHODS

Experiment I

30 mongrel dogs were divided into 5 groups (groups A, B, C, D, E). In the first four groups, aortic occlusion was maintained for 25, 35, 45 and 60 min respectively, and group E, in which only laparotomy was done without aortic occlusion, served as control. Before experiment weight and body temperature of the animals showed no significant difference (P>0.05). Under intraperitoneal anesthesia, the abdomen was opened by an epigastric incision. In the dogs of the first 4 groups the aorta was freed from the diaphragm and clamped. Arterial and central venous pressure were measured through arterial and venous catheters inserted into the vessels of the forelimbs. Blood gases were measured from the arterial sample, and blood biochemistry from the samples of the central vein.

Experiment II

3 dogs from each of the groups A, B, C and D were taken. Tissues of the liver, kidney, pancreas and intestine were
taken at 15, 25, 35 and 45 min after aorta clamping. 3 other dogs, operated on, served as normal controls. One dog of group A survived after 25 min aorta clamping and was killed at the 30th day, and the aforesaid seven organs were taken. Tissues of cerebrum, spinal cord and lung of another 15 dogs were harvested after 15, 25, 35, 45 min of aorta clamping (3 dogs were used as controls, 3 dogs for every time group). All tissue specimens were fixed, dehydrated, sliced, double-stained and observed with H-500 type electron-microscope.

RESULTS

1. Postoperative survival
All 6 dogs in group A could survive for a long time. In group B and C all animals died at 1198 ± 556 and 741 ± 261 min after release of clamping respectively, though few recovered consciousness for a short time.

The animals in group D never regained consciousness, and respiration and heart beat stopped at 45 ± 34 and 51 ± 34 min after declamping respectively. The findings in group E animals were the

Fig.1.BP, CVP, HR, RF before and after clamping and declamping