

Effects of Vagotomy on Morphous and Function of Mesenteric Lymphatic Vessel

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Abstract Objective To study the dynamic changes of mesenteric lymphatic vessels responded to Vagotomy. **Methods** 30 New Zealand rabbits were divided into the experimental group and control Group, and the experimental group was composed of three sets. The vagotomy was taken in experimental group, and the hydrodynamics of mesenteric lymphatic vessel and the morphologic change of the walls of small intestine were observed before denervation and a week, two weeks, four weeks after denervation respectively. **Results** After denervation, the pressure of mesenteric lymphatic vessel rise up obviously at once and recover gradually. One or two weeks after denervation, small intestinal mucosa appears inflammation and epithelium destroyed. Each layer of lymphatic vessel expand, especially central chyle vessels. Four weeks after denervation, the appearance is repaired generally. It showed that injuring of vagus in a short time will affect the morphology and function of small intestinal lymphatic system. **Conclusion** The results of this experiment hints that vagus n. play an important adjustment to the function of small intestinal lymphatic system.

Key words small intestine; lymphatic vessel; vagotomy; hydrodynamics

Vagotomy begin to be applied in the clinic in 40's in 20th century, it is referred to the peptic ulcer treatment. The operation become to the most ideal therapeutic tool in theory and it has obvious curative effect in practice. But after operation, the complications, such as emaciation, diarrhoea, constipation and so on, can be seen frequently, which influence the extensive application of vagotomy. However carcinoma of esophagus and gastric cancer's radical excision will damage vagus inevitably, which will lead to autonomic nerve functional disorder in stomach and intestine, and affect patient's postoperative recovery and quality of life. Many researches about the change of gastric tissue small intestinal blood supply and the change of intestinal motility have been reported. But there is no report about the functional change of small intestinal lymphatic system. This experiment observe the change

of mesenteric lymphatic vessel pressure and flow volume and the morphologic change of small intestinal lymphatic vessels, which provide a reference for diagnose and prognosis of vagus nerve disease.

MATERIALS AND METHODS

Materials

Thirty New Zealand rabbits were selected, their weight is from 1.5 to 2.5 kg. Then they were divided into experiment group and control group at random. Experiment group is composed of three sets: the set of a week, two week, four week after denervation.

Methods

In experiment group, the vagotomy operation was as following: first, the anesthesia was taken through the marginal vein of ear, and the median incision was made in abdomen of the rabbits, small intestine was pull out, and the mesentery was outspread smoothly and then cannulation reversing lymph flow was taken and pressure of the lymph was measured. Then a segment of lymphatic vessel was dissociated and was cut

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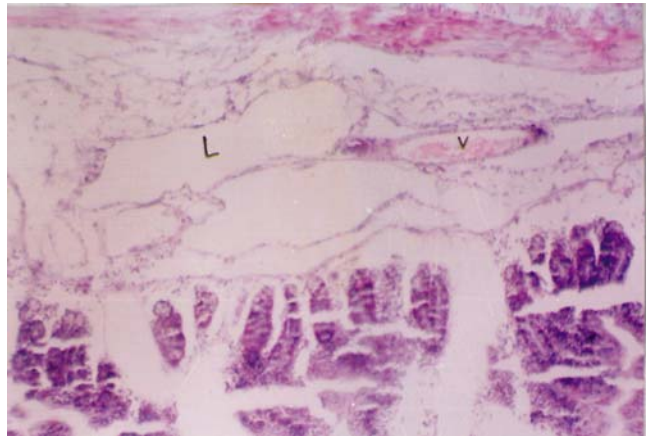
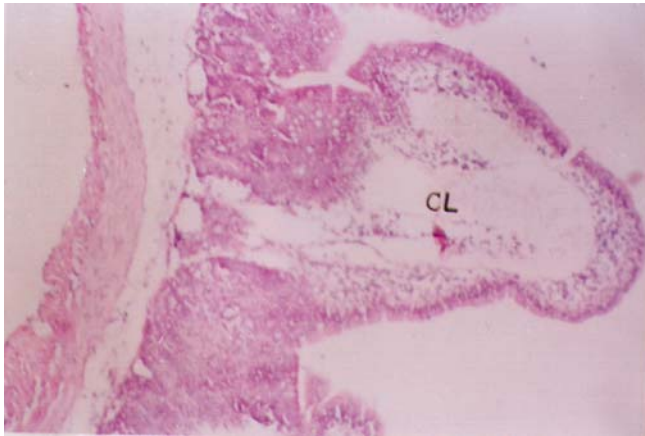


Fig1, Fig2: Mucous membrane shrink, willus step down, central chyle vessel expand extremely.

off, the volume of lymph flow was recorded. After closing the broken ends of lymphatic vessel, the vagotomy at lower esophagus was performed, the lymph pressure and the volume of lymph flow were measured and recorded again, then abdomen was closed. The second operations were carried out in a week, two weeks and four weeks after denervation, the lymph pressure and the volume of lymph flow were measured and recorded. The proximal jejunum and mesentery was cut off to observe its pathology. In control group rabbits, the experiment step is the same to a week set excepting not cut off vagus,. The experiment results were analysed with T-test.

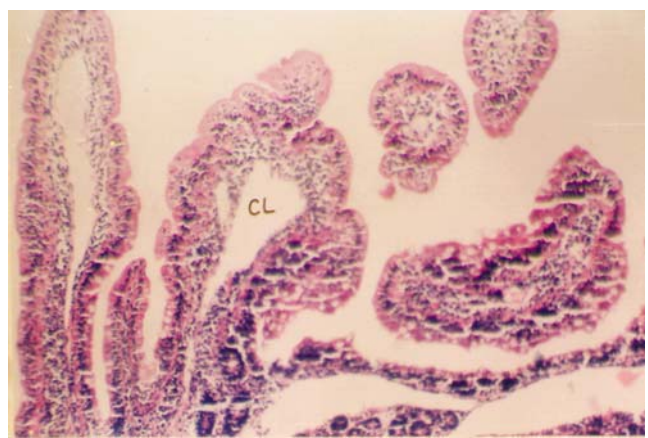


Fig3: The end of central chyle vessel expand and intumesce, villus shows drumstick.

RESULTS

The effect of vagotomy on the pressure of mesenteric lymphatic vessel

The pressure of mesenteric lymphatic vessels was 0.32 ± 0.09 kpa before denervation and may rise rapidly up to $0.98-2.94$ kpa when massaging the small intestine. After stoping massage, the pressure descends gradually. After the operaion of vagotomy, the lymph

pressure of mesenteric lymphatic vessels increase to 1.42 ± 0.22 kpa quickly. Massaging may promote the lymph pressure of mesenteric lymphatic vessel to increase further .After stopping the massage, the lymph pressure of mesenteric lymphatic vessel descend but did not return to normal, which may be keeping at a higher level. After the second operation the change of lymph pressure of mesenteric lymphatic vessel is no significance compared with that before operation.(see Table 1).The lymph pressure of mesenteric lymphatic

Table 1 The change of the lymph pressure before and after denervation

	Before denervation	After denervation	The second operation
Experimental group	0.32 ± 0.19	$1.42 \pm 0.22 *$	0.33 ± 0.11
Control group	0.32 ± 0.09	0.33 ± 0.13	0.32 ± 0.12

* compared with before denervation (P< 0.01)

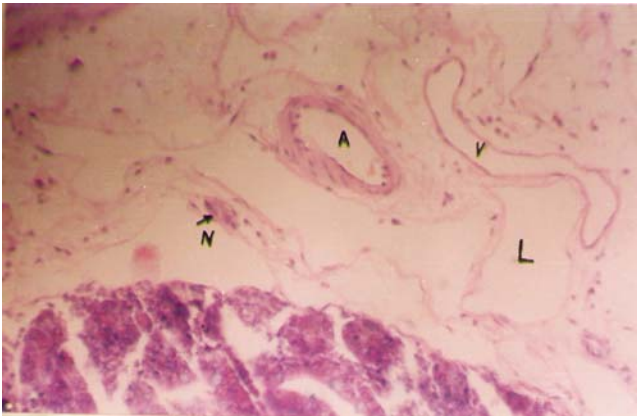


Fig4: Inflammation fade away, the shape is repaired basically.

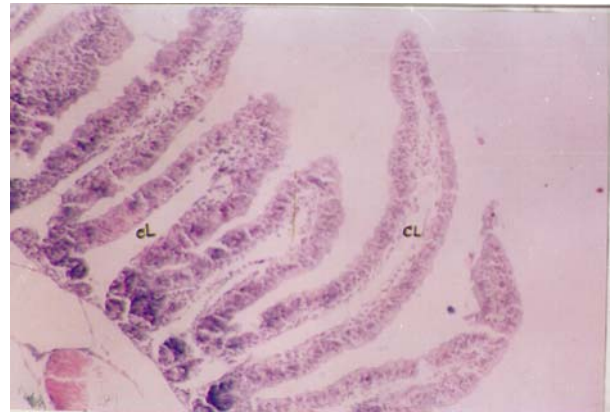


Fig5: Mucous membrane of small intestine is integrity, villus shows digitatio. Central chyle vessel engorge well.

vessel in control group had no obviously change.

The flow change of mesenteric lymphatic vessel responded to vagotomy

Chyle flow from the cutting ends of lymphatic vessel discontinuely. The flow volume of a simple lymphatic vessel is little. Before denervation, it is 0.5~2 drop/min, after massaging, the flow volume rose up to 3~6 drop/min. After denervation, the lymph flow is very little and is very difficult. After the second operation, the lymph flow in the one week set and the two weeks set was not so many as 1 drop/min, in the four week set it is close to before operation.

The morphologic change of small intestine after denervation

Observation of macrostructure: a week after denervation, small intestine is engorge and oedema obviously. Small intestine is acoprous, mesenteric lymphatic vessels showed unclearly. Two weeks after denervation, the lymphatic vessel is not impregnated fully. The oedema and inflammation of small intestine relieved. Four weeks after denervation, the appearance of small intestine is restored basically. Intestinal contents is more and the lymphatic vessel is well perfused and is milk white in color .

The change in histology: a week after denervation, the layers of wall of intestine presented inflammatory cell infiltrated, especially in mucous membrane. The epithelial layer destroyed, Besides there appears spot-shaped desquamated, mucous membrane shrink, villus step down, central chyle vessel expand

extremely (fig1, fig2), the vessels of of the submucosa and mesentery were congested, lymphatic vessels expanded. Two weeks after denervation, the mucous membrane were still inflammatory. The end of central chyle vessels expanded, the villus showed in drumstick (fig3), pathological changes of submucous and mesentery relieved. Four weeks after denervation, inflammation fade away, the microstructure was repaired basically (fig4). In the control group: the mucous of small intestine is integrity, central chyle vessels were perfused well. (fig5)

DISCUSSION

In this experiment, after the operation of vagotomy the pressure of mesenteric lymphatic vessels rose obviously at once, which displayed the feature of adrenergic nerve excitation. This finding is consistent with the conclusion that contract strengthen of mesenteric lymphatic vessels result from stimulating greater splanchnic nerve of sheep [2]. Lymphatic vessel exists voluntary contract which is subject to the adjustment of neuro-humor factors. There are many nerve fibers of cholinergic, adrenergic and peptidergic. These fibers are distributed to adventitia, muscular layer even to subendothelial layer [3-5]. It can deliver stimulative message of chemical, mechanical and temperature. The centrifugal nerve can modulate the contract of smooth muscle. Under the physiological condition, adrenergic nerve and vagus moderate the internal organs activity together . After denervation of vagus nerve, it will

lead to the interruption of passage of afferent and efferent and the function disturbance, which may result in the relative excitation of adrenergic nerve.

A week after denervation, the pressure of mesenteric lymphatic vessels restored to normal level. Because the fundamental stimulating factor of lymphatic activity is the change of tense resulting from the change of lymphatic flow volume [6]. In the early of the vagotomy, adrenergic nerve excited relatively, the contract of lymphatic vessel speed up, transporting of lymph strengthen. But lymph formation is limited. With the decrease of intravascular lymph, the stimulation to sympathetic nerve reduced. By the way of feedback regulation, the activity of mesenteric lymphatic vessel restore to the preoperative level in order to adapt to the requirement of the normal physiological functions .

After denervation of vagus nerve, it broke the balance of small intestinal neural regulation . Small intestinal blood supply, lymph drainage, endocrine and movement will be affected. At the same time gastric acid secretion decrease, the ento-environment of intestines changed , PH value increased and the adaptive ability reduced, which easily produces inflammation and histologic damage. When small intestine lose the innervation of vagus, mucous membrane takes place denervating neuratrophia^[7] .

There may be many reasons for the expand of lymphatic vessel: (1) Small intestinal activity was weak after denervation, which made driving force of chyle recirculate diminish and resulted in chyle stiltation. (2) Congestion: It was report that the regurgitation volume of mesenteric vein may decrease to 42 % or so after cutting off vagus nerve^[8], which leads to interstitial fluid increase and the wall of intestines dropsy and lymphatic vessels were expanded compensatively. (3) Inflammation increase vasopermeability and makes interstitial fluid volume rise up, (4) When neural regulation of lymphatic vessels is disbalance, the adaptive ability descend

The research on the relation among lymph and nerves in the wall of small intestine is still little, There exist extremely complicate nerve distribution in small intestine. Besides adventive sympathetic postganglionic

fibers, parasympathetic preganglionic fibers and peptidergic fiber , there are enteric nervous system of small intestine by itself. Paraneuron of lymphatic vessel, seen in submucous of all groups in the experiment, is close to lymphatic vessel, there only exist a layer of basal lamina between them .This finding is coincide with the research of Lijun. Some scholar find SP-CGRP fibers under the endodermis of central chyle vessel in duodenum villi of the dog ^[9] . These fibers have important role in transmitting chemical, mechanical energetic change and regulating lymph-vascular actuation.

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