Magnified Endoscopic Observations on the Healing Process of Experimental Ulcers

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Experimental gastric ulcers in the canine stomach were observed and followed up using a magnifying endoscope. There were differences in the healing processes between antral ulcers and ulcers on the corpus. Antral ulcers were healed linearly by epithelization with a glandular structure, and ulcers on the body were healed by covering with a single layer of epithelium without pit-formation and the scar resembled a shallow depression. These differences were thought to be caused by differences in blood flow, mucosal regenerability and glandular structure.

(Key Words: Experimental Gastric Ulcer, Process of Ulcer-healing, Magnifying Endoscopy)

Magnifying endoscopes are now coming into use in Japan for observations of the mucosal surface of the stomach. The authors have tried to observe and follow-up the healing process in the experimental gastric ulcers using this endoscope.

MATERIALS AND METHODS

Under pentobarbital anesthesia (20mg/kg i.v.), experimental gastric ulcers were induced endoscopically both in the acid-secretion area (body) and the non-acid-secretion area (antrum) of three mongrel dogs, weighing 10 to 12 kg using an electrocoagulator. The borders of the areas were decided endoscopically by the Congo-red method. The procedures were performed on the same dog two or three times at proper intervals to produce ulcers of different stages. Forty-eight hours, one week and two weeks after the procedure, ulcers were observed and recorded with an ordinary endoscope and a magnifying endoscope (GIF-HM, Olympus Co., Japan). Prior to the examination, ulcers and neighboring mucosa were washed with sufficient amounts of dimethyl polysiloxsane solution (Gascon Drops, Kissei Co., Japan) and protease solution (Pronase, Kaken Chem. Co., Japan) to remove adhering mucus. Then the dogs were sacrificed and the resected stomachs were observed microscopically.

RESULTS

Just after the procedure, central red spots, a surrounding white zone and a red halo were seen in the ulcers on the antrum. In the magnified...
observations, partial dilatation of the capillary network and micropetechiae were seen in the surrounding red halo. The ulcer on the body had almost the same characteristics as that on the antrum (Fig. 1).

Forty-eight hours later, the mucosa from the central red spot to the surrounding red halo desquamated from gastric wall and a deep ulcer was seen on the antral wall. The surrounding mucosa was edematously swollen and a slight fold convergence was recognized. The ulcer floor was prone to bleeding. The ulcer margin was clearly bordered and angled. Some red spors (regenerating capillary vessels) were seen on the margin of the surrounding mucosa. Capillary vessels were not observed on the ulcer floor. However, regenerating or remaining capillary vessels were seen on the floor and many red spots were noted on the marginal mucosa of the ulcer on the corpus (Fig. 2).

One week later, edema of the surrounding mucosa of the antral ulcer decreased. Some red spots were seen on the ulcer floor. The ulcer margin was still clearly bordered and angled. However, the ulcer on the body had become shallow and regeneration of the capillary network on the ulcer floor was clearer than that on the antral ulcer. Radial capillarization was seen on the marginal mucosa (Fig. 3).

Two weeks later, the ulcer on the antrum healed linearly with fold convergence. Magnified endoscopic observations revealed that regenerating epithelia with irregular pits approached from both sides and covered the ulcer floor. The ulcer on the corpus resembled a shallow depression. Under endoscopic magnification, a capillary network and radial vessels were seen on the shallow floor. At this time, microscopic examination revealed that the depressed floor was covered with onelayer of epithelium without a glandular structure (Fig. 4).

COMMENTS

Experimentally, a chronic ulcers on the canine stomach have been induced by cinchophen administration, formalin infusion in vessels and by acetic acid infusion in the gastric wall. In small animals, the clamping-cortisone and mucosa-desquamation methods have been used (1, 2, 3, 4, 5).

In canine studies, ulcers were observed and followed up by ordinary endoscopy (1) or by sacrificing with time. In the studies using small animals ulcers on the resected stomachs were mainly observed using a light microscope (5).

In our study, ulcers were induced by an electro-coagulator endoscopically and the healing process on the ulcer margin was observed and followed-up using a magnifying endoscope. A magnifying endoscope has a maximum magnification of 30 fold. By using this endoscope, the mucosal pit pattern, capillary network and regeneration of vessels can be observed.

From the results of our study it was assumed that there were some differences in the healing process between antral ulcers and ulcers on the gastric body. The antral ulcer was healed by covering regenerating mucosa with glands (irregular pits) and the scar was linear, but the ulcer
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on the gastric body was healed by covering with one layer of epithelium without glandular structure on the ulcer floor, and the scar resembled a shallow depression. Basically, it was assumed that there was a difference in the process of glandular regeneration between the ulcers in the acid-secretion area and in the non-acid-secretion area. These differences were thought to be caused by differences in blood flow (volume and capillary distribution), in mucosal regenerability and in glandular structure between the two areas.

This is a preliminary report on observations of experimental ulcers using a magnifying endoscope. The authors will discuss and report the methodology for inducing ulcers and the differences between experimental and human peptic ulcers in the next paper.

REFERENCES
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Fig. 1  Experimental ulcer on the antral wall just after its induction by an electro-coagulator
Left: Ordinary endoscopic observation shows a central red spot, surrounding white zone and red halo.
Right: Magnified observation of the surrounding red halo reveals micropetechiae and capillary dilatation.

Fig. 2  Endoscopic pictures 48 hours after the procedure
Upper-left: Antral ulcer shows severe marginal swelling.
Upper-right: The border of the antral ulcer margin is clear and angled.
Lower-left: Body ulcer shows capillary regeneration.
Lower-right: A capillary network is seen in the ulcer floor on the body.
Fig. 3  Endoscopic observations one week after the procedure
Upper-left: Marginal swelling of the antral ulcer decreased.
Upper-right: Margin of the ulcer floor is clearly bordered and angled (antral ulcer).
Lower-left: Ulcer on the body shows vigorous capillary regeneration.
Lower-right: Capillary network and radial vascularization are seen on the ulcer floor (ulcer on the corpus).

Fig. 4  Ulcers two weeks after the procedure
Upper-left: Antral ulcer is healed linearly.
Upper-right: Magnified observation shows that regenerating marginal epithelium covers the ulcer floor.
Lower-left: Ulcer on the body resembles a shallow depression.
Lower-right: A capillary network is seen on the floor with a magnifying endoscope.
   At this time, one layer of epithelium covers the floor.