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SWAN-TYPE DOUBLE-BENDING GASTROFIBERSCOPE

BY

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ABSTRACT

The invention of the swan-type double-bending gastrofiberscope solved the pending problem of observing the posterior wall of the upper part of the body of the stomach and the frontal view just below the cardia.

It also made possible the close observation of the pyloric region which was another old pending wish of those using the gastrofiberscope.

Moreover, this new scope can be inserted into the pyloric ring closely along the lesser curvature because the new scope had a lower bending part.

This fact is an unexpected fruit for the inventor and is now expected to form the basis of the development of the typical duodenofiberscope.

INTRODUCTION

It is everyone's dream to use an endoscope to observe satisfactorily the pathologic foci of the stomach from the most advantageous points by freely moving the tip of the fiberscope. The Swan-type double-bending gastrofiberscope made this dream come true. It can be said that this is the gastrofiberscope of the 1970's.

I. CHARACTERISTICS OF SWAN-TYPE DOUBLE-BENDING GASTROFIBERSCOPE

Endoscopical examination is the direct observation with the naked eye of the pathologic changes of the stomach. The assessment of the quality of the scope depends on how accurately the pathologic changes can be observed.

(1) Multiple observations

In order to observe accurately the pathologic foci no minute changes should be overlooked. For this reason the pathologic foci should be observed obliquely and from the front, and the frontal observation should also be made from the left to the right as well as from the front to the back. In the stomach the posterior wall of the upper part of the stomach is the most difficult part to observe.

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(2) Close observation

To diagnose the minute changes of the gastric mucosa accurately, the objective lens of the scope is moved close to the pathologic foci and the foci are enlarged. For the observation of the minute changes of the stomach, close observation is most important.

(3) Importance of this new type of endoscope

For those who wish for speed in diagnosis by endoscopy, it will be very helpful to use a new type of endoscope with a new type of mechanism. This new type of endoscope is a great improvement over the older types of endoscopes.

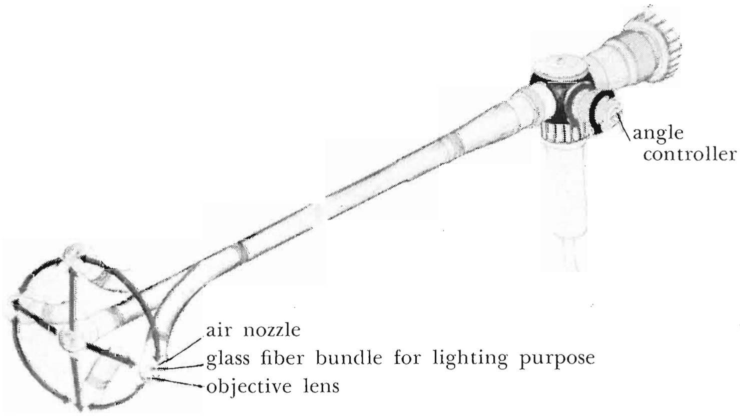


Fig. 1. Fiber -Esophagoscope with angle device (Inaba) 1964. The first fiber-esophagoscope with an angle device made in Japan in 1964 and exhibited by Inaba at the Symposium at The First World Congress of Gastrointestinal Endoscopy in 1966.

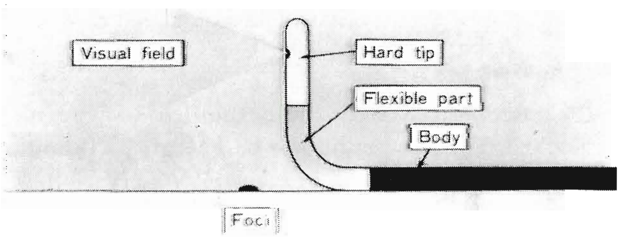


Fig. 2. Gastrofiberscope with angle device (Inaba) 1964. The first angle device in the world designed in 1964 and was adopted to various kinds of fiberscopes. Recently a flaw was pointed out that it is not always easy to adjust simultaneously the distance from the foci and the optical axis.

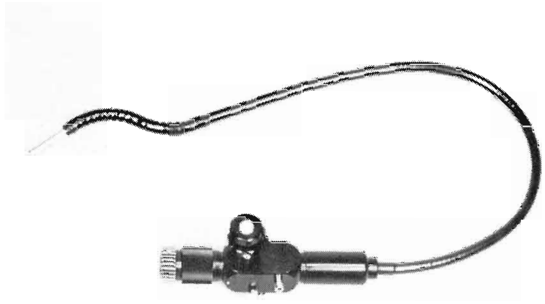


Fig. 3–a. Double-bending Gastrofiberscope (Inaba) 1967. Double-bending machanism was devised in 1967. This scope was manufactured by the Fuji Photo Optical Co., Ltd., in 1968.

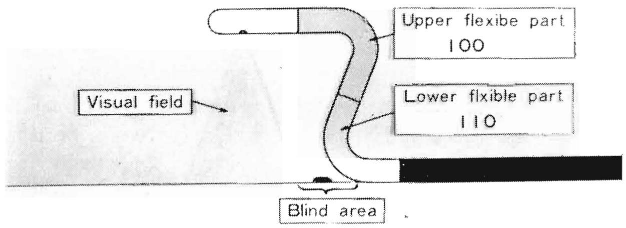


Fig. 3–b. Characterized by double-bending mechanism in the opposite directions remotely controlled. Revealed to have a blind area between the visual field and the lower flexible part, in 1969.

II. Theory of Swan-type Double-bending Gastrofiberscope

In order to observe the pathologic foci of the stomach satisfactorily, first of all the tip of the scope must be manipulated satisfactorily by remote control. This is because the tip of the scope is the eye of the examiner.

(1) Hirschowitz type, 1958

This type of scope was abandoned in Japan in 1966 after four years of use. The main reason was that the tip of the scope could not be manipulated.

(2) Gastrofiberscope with Angle Device (Inaba), 1964

A flexible section was placed between the hard tip and the body of the scope and the tip of the scope was manipulated by remote control by means of two to four pieces of wire. This was the first of its kind in the world, and

Table 1. Theory of Swan-type Double-bending Gastrofiberscope

Distance-regulating mechanism:

To adjust the distance between the tip of the scope and gastric mucosa.

Optical axis-regulating mechanism:

To direct the optical axis of the scope toward the pathologic foci.

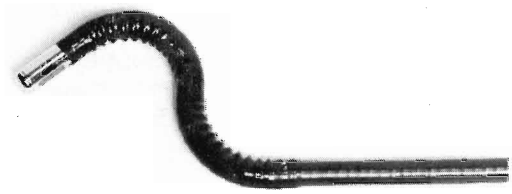
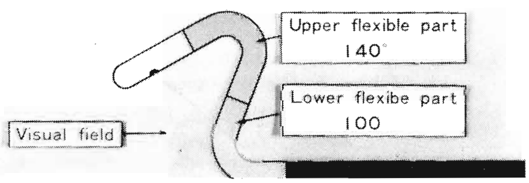


Fig. 4–a. Swan-type Double-bending Gastrofiberscope (Inaba) 1969. The upper and the lower flexible parts can be bent to a maximum angle of 140° and 100°, respectively.



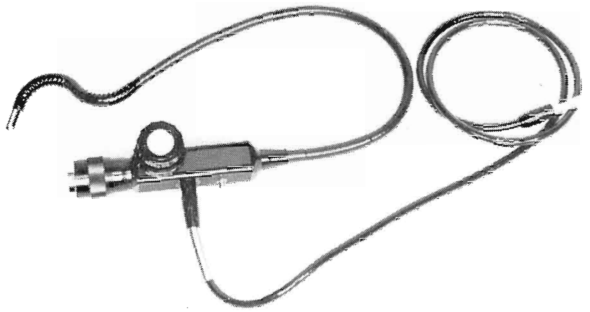
Foci

Fig. 4–b. The lower flexible part can be observed freely.

later this mechanism was adopted on all scopes. However, those using this scope gradually became dissatisfied with it. The main reason for this was that the objective lens of the scope could not be directed toward the pathologic foci (Figs. 1, 2.).

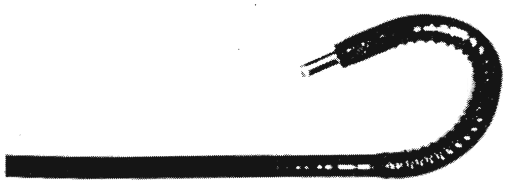
(3) Double-bending Gastrofiberscope (Inaba), 1967

To observe the gastric mucosa with a scope the following two mechanisms are necessary for the scope: the first is the mechanism to adjust the distance between the tip of the scope and the gastric mucosa, and the second is the mechanism to direct the objective lens of the scope toward the path-



a. The whole scope: Characterized by the relatively short effective length of 76 cm.

b. Ocular part: Two handles of the angle device are piled up one over the other, and each has a stopper.



c. The tip: Can be bent over 200° when the two parts are bent in the same direction.

Fig. 5. Swan-type Double-bending Gastrofiberscope.

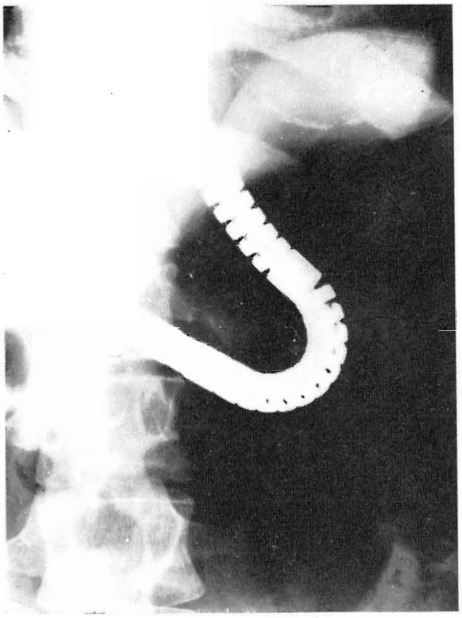


Fig. 6-a. X-ray photograph during manipulation of Swan-type Double-bending Gastrofiberscope. When the upper flexible part is bent to 140°, the body of the scope is seen in the center of the visual field.

ologic foci. In order to satisfy these two requirements, the tip of the scope must be able to bend twice in the opposite directions (Fig.3 a, b, Table 1).

(4) Swan-type Double-bending Gastrofiberscope (Inaba), 1970

With the first double-bending type of gastrofiberscope, the posterior wall directly below the cardia could not be observed. This was because there was a blind spot between the visual field and the lower flexible part. To observe this blind spot, a mechanism which will always permit the observation of the lower flexible part is necessary. The Swan-type double-bending gastrofiberscope was devised to satisfy this requirement. The name Swan-type was given to the device because the form of the scope is just like the S-bend in the neck of a swan (Fig. 4-a, b).

III. Practical Aspects of Swan-type Double-bending Gastrofiberscope

The essential feature of the mechanism of this scope is not the length of the flexible parts but the extent to which the flexible parts can be bent.

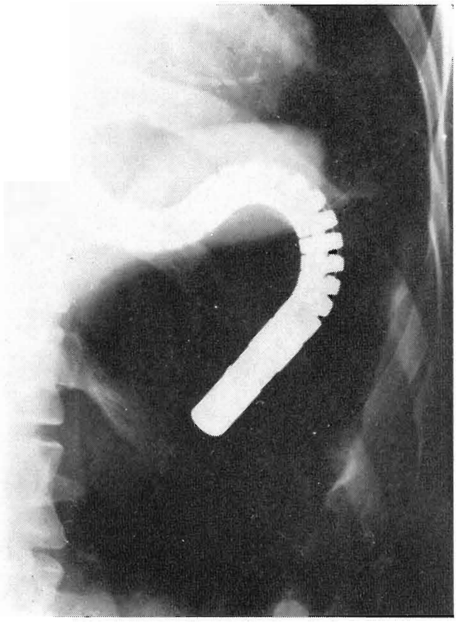


Fig. 6–b. Double bending in the left-right direction. The lower flexible part and the lesser curvature directly below the cardia are observable.

(1) Mechanism

Just below the hard tip of this scope is the upper flexible part and below the upper flexible part is the lower second flexible part. The scope has a light guide system. The upper flexible part can be bent to a maximum angle of 140° and the lower flexible part can be bent to an angle of 100°, and both can be bent both backward and forward. The distinctive characteristic of this scope is that it has two flexible sections capable of bending up to 140° and to 100° (Fig. 5-a, b, c).

(2) Directions for use

When the upper flexible part is bent downward 140°, the lower flexible part can be observed. When the lower flexible part is bent downward to 100°, the visual field moves away from the body of the scope, but the lower flexible part can always be observed in the visual field (Fig. 6-a, b, c).

(3) Observation of posterior wall of upper part of body of stomach

When this scope is bent into a swan-like shape, the front view of the posterior wall directly below the cardia can be observed. When the curvature of the upper flexible part is decreased a little, the front view of the posterior wall of the part directly below the cardia, the upper part of the

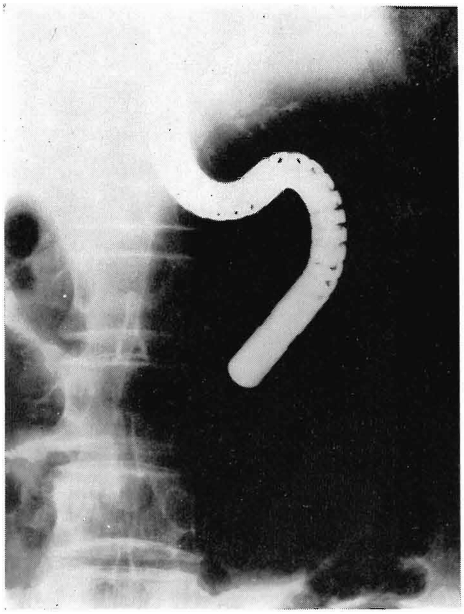


Fig. 6–c. Double bending in the anterior-posterior direction. The lower flexible part and the posterior wall directly below the cardia are seen in the visual field.

(a)

(b)

Fig. 7–a. Gastroscopic findings of lesser curvature directly below the cardia. Observed from the left-right direction. The black part is the lower flexible part of the scope.

Fig. 7–b. Gastroscopic findings of posterior wall directly below the cardia. Observed from the anterior-posterior direction. The black part is the lower flexible part of the scope.

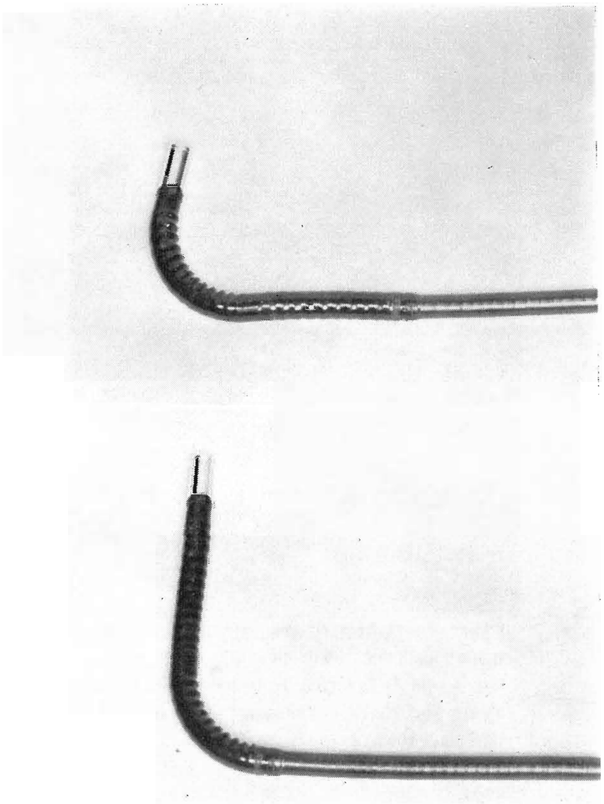


Fig. 8. Close observation of the pyloric region. The visual fields are entirely different whether the upper or the lower flexible part is bent. The bending at the lower flexible part makes possible the approach to the pyloric ring.

body, the body, and the gastric angle can all be observed progressively (Fig. 7-a, b).

(4) Close observation of the pyloric region

When the upper flexible part is bent, the tip of the scope approaches the lesser curvature of the pyloric region a little to the side of the gastric angle, but when the lower flexible part is bent the tip approaches the lesser curvature of the pyloric region a little to the side of the pyloric ring, and accordingly observations can be made of these parts. When both flexible parts are bent in the same direction, or when the upper flexible part is bent downward and the lower flexible part is bent upward, observation can be made of the parts very near the pyloric ring (Figs. 8, 9-a, b).

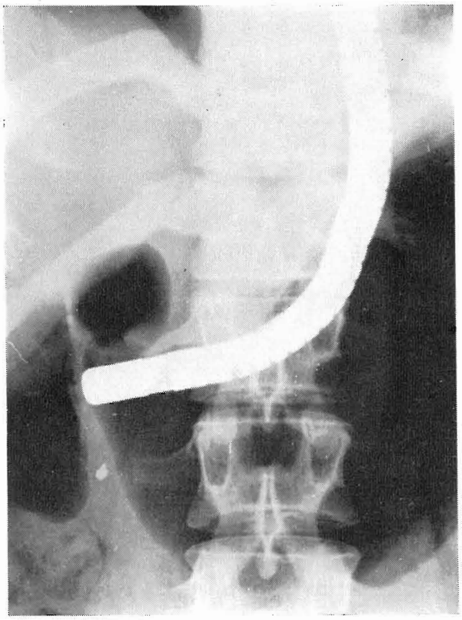


Fig. 9–a. Close observation of the pyloric ring. When both the upper and the lower flexible parts are bent upward, the scope is inserted into the pyloric region closely along the lesser curvature. The lens of the scope is directed toward the pyloric ring.

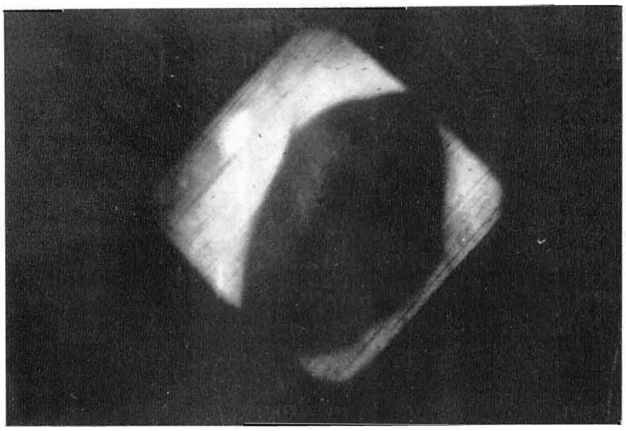


Fig. 9–b. The pyloric ring appears largely because of the very close approach of the lens.

(5) Observation of greater curvature

When the scope is directed toward the lesser curvature and the upper flexible part is bent back and forth, the greater curvature from the pylorus to the fundus can be observed progressively. This is because the upper flexible part forms a small, tight curve and can be said to be an epoch-making discovery.

Conclusion

As long as gastrofiberscopes are not ideal, we must strive to attain the ideal. The swan-type double-bending gastrofiberscope is the gastrofiberscope of the 1970's, conceived by theoretical studies, produced by an accumulation of the results of three years of research, and now proven after many clinical applications. It allows every part of the stomach to be closely observed without any blind spots. This apparatus is manufactured by the Fuji Photo Optical Co., Ltd.