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On the Gastric Varices
Its Roentgenographic Features and Diagnostic Method

By

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胃 静 脈 瘤 の X 線 診 断 に つ い て

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本症は主に門脈圧亢進症にみられ、従来この方面的の主役を演じていた食道静脈瘤と同格に扱われるべきものであり、食道静脈瘤に先行するものであることが、その頻度から証明された。この結論は、噴門部を en-face に二重造影で正確に捕える手技を修得しなければ成立し得ない。

そのX線所見は、形として類円形ないし紐状の隆起としてみられ、腫瘍状、ポリポイド状、巨大

皺襞状として表現される。隆起は一般に低く、胃のふくらみに左右される。単発は稀で、多発集簇の傾向があり、1つ1つの静脈瘤の輪郭は平滑であるが、決して鮮明ではない。特に中心から離れた周辺部の正常部への移行は全く不明瞭である。最も Pathognomonic な所見は体位、呼吸相、空気量によつて形・大きさ・隆起度・輪郭が変化することである。

Aquired or congenital varices of the digestive tract are formed without the portal hypertension, but these events are originated mainly in the portal hypertension.

It has been reported that these varices tend to develop chiefly in the esophagus and few in the stomach. Moreover, in the literature, only a case report of varices in the duodenum and large intestine is respectively found.

According to the advanced technique of the barium examination in the cardiac regions, recently the gastric varices have been observed more frequently than those of the esophagus. For instance, in a patient complaining of hemoptysis and hematoemesis, the esophageal varices occasionally have not been observed in spite of having the gastric varices.

In 1948, Samuel had studied roentgenographically the four cases and reported precisely these X-ray findings of the gastric varices by the double contrast method combined with the Schatzki's method, it was still more important that he has concluded saying that the gastric varices had occurred antecedent to those of the esophagus.

Thereafter several reports similar to these have been occasionally recognized but it left something to desired. These facts have been based upon the ability of low-grade of X-ray analysis and the roentgenographical techniques in the cardiac regions.

The purpose of this report is to describe the general, detailed radiological findings and the developmental site of the gastric varices in the 39 available cases observed during the late five years.

Branches of collateral blood vessels in the portal hypertension

Increasing the pressure in the portal vein, regurgitation of the blood flow occurs. That is its bypass as follows 1) from v. cor. gast. v. gast. brev. and v. gastroepipl. to the esophageal vein, 2) through v. mesent. inf. to the rectal vein, 3) via paraumbilical vein, to the abdominal parietal vein.

In addition, there are so complicated branches as 1) plexus of sappey's vein and venous plexus around the liver, 2) Rezius' venous plexus (connecting to the inferior caval vein in the mesenteric radix) and 3) venous plexus in the spleno-renal connection.

These may be summarized as follows. (Fig. 1)

In this way, varices may develop everywhere those collateral branches of the veins are formed, that is, not only in the digestive tract but also in mesenterium, retoroperitoneum (membrane) and abdominal wall.

Veins concerning with formation of the gastric varices.

Especially the coronary gastric vein plays an important part. The gastroepiploic vein has a complicated connection with the short gastric vein. On the other hand, the coronary gastric vein and the short gastric vein are connected, and numerous complicated venous plexus occur in the subserosal and submucosal site of the cardiac area. These branches may anastomose with those in the esophagus and venous plexus around the esophagus.

Fig. 1. Showing the collateral branches of blood vessels in the portal hypertension.

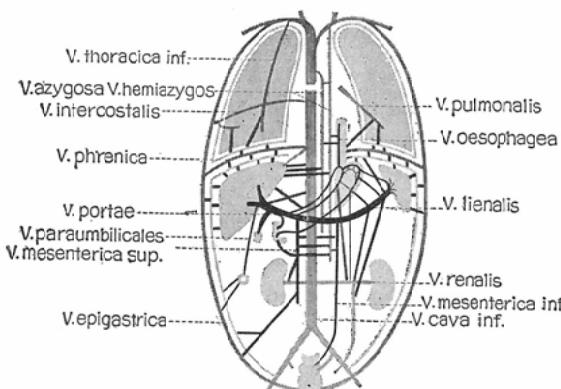
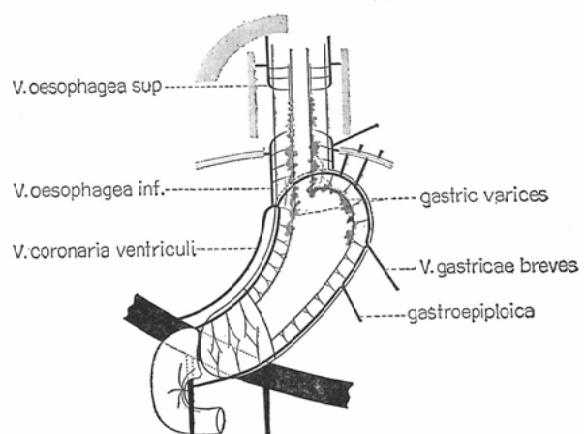


Fig. 2. Venous system concerning with formation of the gastric and esophageal varices.



The lower esophagus vein originating from the coronary vein branches in the subserosal site of the esophagus and these branches connect with the upper esophageal veins, supplying fine branches in the submucosal area of the esophagus.

The direction of the blood flows in the portal vein shows a reversed way contrast to the general.

Thus the portal blood flows into the above mentioned veins, or venous plexus, and these veins dilate in the cardiac area including the abdominal esophagus (in abdominal esophagus too difficult to develop

varices because of its tightness of the submucosal connective tissues) and moreover in the region of the thoracic esophagus (Fig. 2).

Age, Sex, and Fundamental diseases of gastric varices in the thirty-nine cases.

The distribution of age in thirty-nine cases of the gastric varices is varied from 12 years to 61 years. They were frequently observed in the thirty (8), forty (14) and fifty decades (9) (consisting of 80% of all cases).

The male may be affected twice as frequent as the female. The fundamental diseases consist of liver cirrhosis (19), Banti's syndrome (14), thrombosis of the portal vein (2), liver tumor (2), splenomegaly (etiology unknown) (2).

These conditions may fall in the category of the portal hypertension.

Roentgenographical techniques to demonstrate the esophago-gastric varices.

Esophagus:

Viscosity of the barium meal: It may be profitable for the relatively concentrated meal to reveal the mucosal pattern and for the thin meal to demonstrate the filling picture.

In the X-ray examination, together with the supine position and the head down position, the erect position is employed.

X-ray spot films should be taken in the filling phase and emptying phase, and it is better to take in an atonic phase of the esophagus.

Valsalva's technique is better to reveal the esophageal varices, but at times, as arresting the venous return from the abdominal vessels by the pinch-cock effect of the diaphragmatic membrane, it may be hindered rather than helped to reveal the esophageal varices.

In general, over six sheet of films should be taken carefully under every position.

Stomach:

The varices may develop commonly from the fornix and around the cardiac area. Therefore it is necessary for making a correct diagnosis to show the en-face images in the cardiac area by the double contrast method.

The existence of the gastric varices may be easily speculated if both the general findings of the gastric varices and signs of the portal hypertension (splenomegaly, esophageal varices etc.) existed.

The cardiac area is ballooned generally by the air of 200—350 ml injected through the nelaton's catheter.

General findings of gastric varices

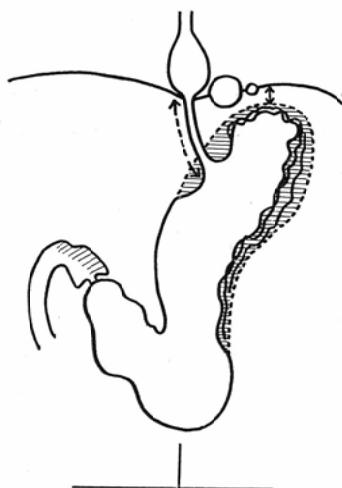
We have collected thirty-nine cases of the gastric varices, but general findings have been dicussed the evidences of only twenty cases which had been correctly controlled by the barium studies (Fig. 3).

Phrenic ampulla: This finding is seen in 10 (50%) of 20 cases. The evidence may be frequently observed in the various condition.

Increase of the phrenico-cardiac distance: In the abdominal esophagus it may be severe to make varices, according to the stiffness of its submucosal layers. But it is seen increased phrenico-cardiac distance caused by the cardiac varices. This is found in 7 (35%) of 20 cases (Fig. 4).

Increase of the phrenico-fornix distance: Varices at the fornix cause the thickening of its wall, so that the

Fig. 3. General findings of the gastric varices



phrenic ampulla	50%
increased phrenico-cardiac distance	35%
increased phrenico-fornix distance	40%
unevenness in the left central diaphragmatic region	20%
irregularity in the inner surface of the fornix	65%
deviation of the stomach to the right	85%
deformity of the stomach	75%
splenomegaly	100%

Fig. 5. (30 years old, male) An arrow shows the defect of the shadow just like an umbrella. The increased phrenico-fornix distance, the irregularity of the inner surface in the fornix and the deformity of the stomach are formed.

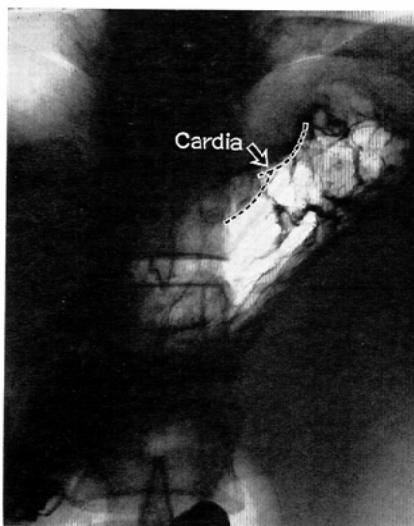


Fig. 4. (32 years old, male) shows the phrenic ampulla, the increased phrenico-cardiac distance with the tumorous shadows in the fornix.

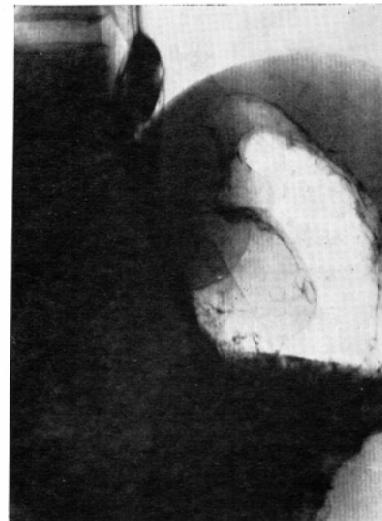


Fig. 6. (23 years old, male) showing the tumorous shadows in the left central diaphragmatic region, demonstrating the varicosity by the splenopertography in the same area.



phrenico-fornix distance is increased. By the way the dilatation of the phrenic vein may be observed roentgenographically. The distance averages 3—5 mm in the erect position. Its maximum is normally at 15 mm. This finding is in 8 (40%) of 20 cases (Fig. 5).

Changes in the left central diaphragmatic regions: The tumor simulating shadows are frequently observed at the left side of the phrenico-esophageal hiatus, but if the lesion is slight, the thoracal surface of the dia-phragma is unevenly demonstrated. This is in 7 (20%) of 39 cases (Fig. 6).

Irregularity of the inner surface of the fornix: This surface is in general mildly uneven, but moreover in this condition markedly, double contours are formed at the fornix and its lumen is narrowed. This is in 17 (85%) of 20 cases.

Deformity of the stomach: This deformity extends from the cardiac area to the fornix, the greater curvature, partially the lesser curvature and the duodenal bulb. The deformity of the large curvature and the fornix is introduced by splenic enlargement rather than the gastric varices. This is found in 15 (78%) of 20 cases.

Splenic enlargement: Being found in the 38 cases of the 39 cases. It shows the 13 cases of high-grade and the 25 cases of middle-grade and the remainder also may be over the normal limit.

The rigidity of the gastric wall and the absence of peristaltic waves: In general, this findings may be found slightly or not be recognized at all.

The detailed findings of the gastric varices.

This findings are mainly discussed on the en-face images (Tabl. 1).

The shape of the gastric varices: They were found as the elevation of the gastric folds, which were expressed just-like oval, semi-round, spindle or cord shaped, tumorous, giant rugae and polypoid appearances.

Table 1. Detailed findings of the gastric varices. (twenty cases)

shape or form	semi-round oval spindle-like	tumorous (3 cases) polypoid (7 cases) giant rugae (10 cases)
grade of the elevation of the gastric folds	in general, the elevation of the folds not so marked, and being within 1 cm.	
margin and contours size or extent	smooth but not sharply demarcated not easily determined but involved within the extent of several centimeters.	
developing features alternations of shapes	multiple, conglomerated induced by the posture, (or physical condition), respiratory phase, amounts of the barium meal and air.	
double contours at the lesser curvature	The contours just like the distorted cords may be formed at the greater and the lesser curvature.	

It is characteristic to modify their shapes in postures and respiratory phases. In general, the features of polypoid or tumorous types appear in center of the involved area, and in peripheral region giant rugae is formed frequently.

The tumorous type in the 3 cases of the 20 cases, in the 17 cases the polypoid type, in the 10 cases the giant rugae appeared. (Fig. 7, 8, 9).

Grade of protrusion: This is influenced by the insufflation of the stomach, and therefore the amounts of the air should be carefully controlled. Only the three cases (tumorous type) show the protrusion of highgrade. The protrusion of the folds is commonly within 1 cm.

Fig. 7. (37 years old, male, tomorous type) Tumorous appearance in the cardiac area and features as the giant rugae are found in the fornix and the greater curvature.

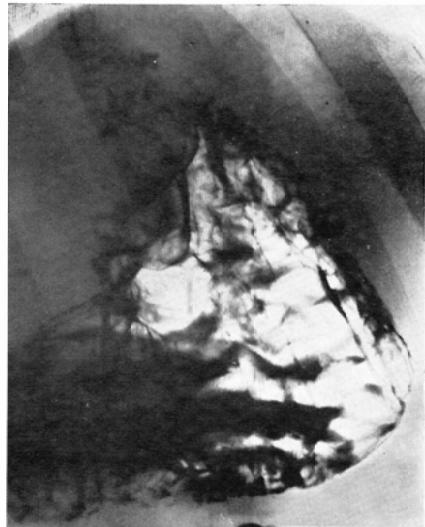


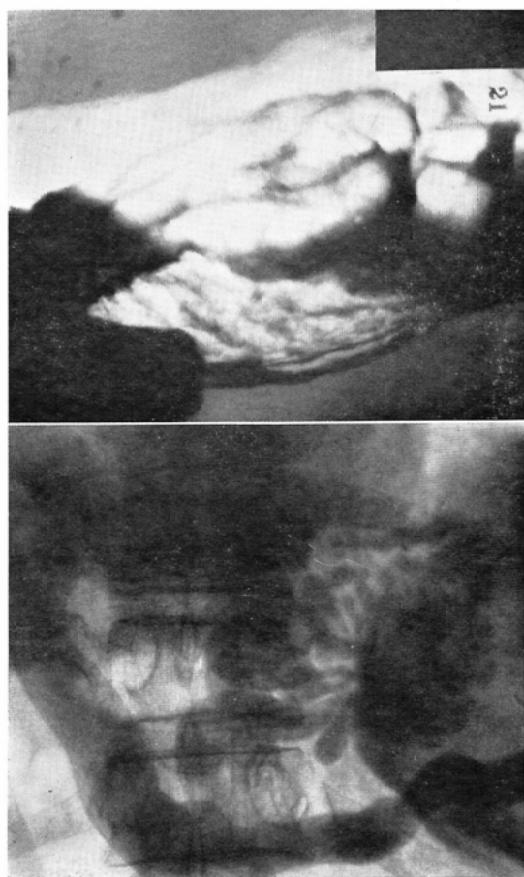
Fig. 9. (58 years old, giant rugae type) shows the feature as the giant rugae in and around the cardiac area.



Fig. 8. (43 years old, male, polypoid type) shows the polypoid elevation of low-grade extensively in the cardiac area.



Fig. 10. (28 years old, male) shows the tumorous appearance in the cardiac area. Notice its margin and contour. Arrows show the varicosity demonstrated by the splenoportography.



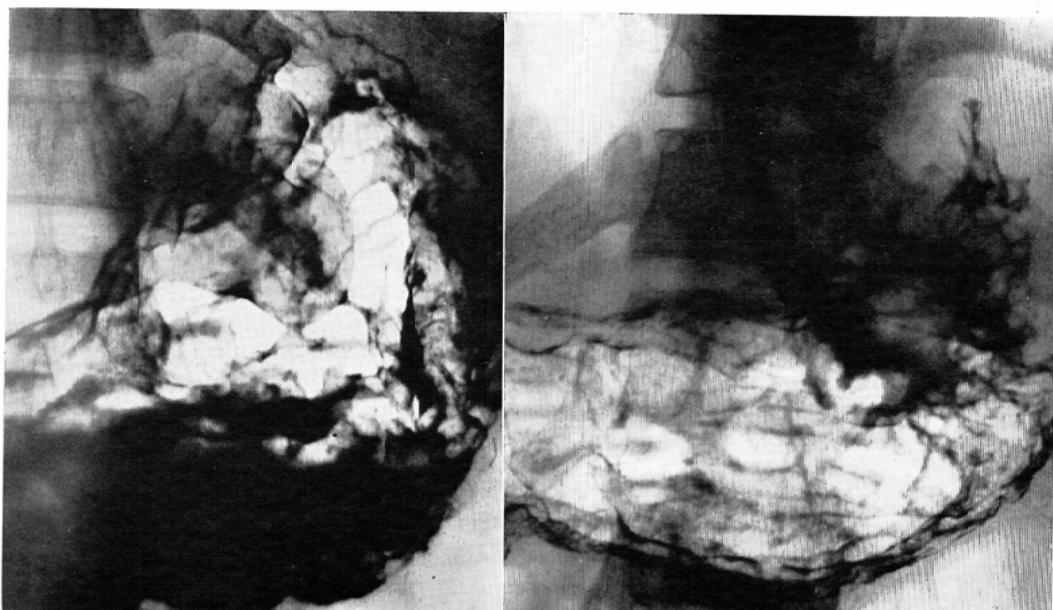
Margin and contour: The margin of every gastric varices may be smooth in the polypoid or tumorous types, but by no means sharply demarcated. The protrusion of the gastric folds becomes gradually low at the margin and forming a dell between the other adjoining varicosity. The features of the contour are not sharply demarcated (Fig. 10).

Size (extent): It does not seem adequate to prescribe the size of every gastric varices because of its rapidly alternating features. These lesions extend commonly to a wide area. Therefore such detailed findings in the early gastric cancer may be unnecessary for the diagnosis of gastric varices.

Developmental conditions: We have not yet found the single tumorous feature in the gastric varices. It is characteristic to take the multiple and conglomerated features in relatively extensive area.

Alternation of the shapes: The features, site and grade of the elevation may be controlled by the posture, the respiratory phase and the amounts of the insufflated air. This is the most pathognomonic in the mentioned findings. (Fig. 11).

Fig. 11. (32 years old, male) tumorous varicosity.



a: Its size and the grade of the elevation may be controlled by the posture, respiratory phase, and the amounts of the air.

b: Notice the alternated shapes of the varicosity and the marked double contours at the both curvatures.

Double contours in the lesser curvature: In the giant rugae, double contours as the distorted cords does not extend as far as the lesser curvature. The most striking findings are manifested in 2 of 20 cases. This is based partially upon the dilatation of the gastric coronary vein and the subserosal varicosity.

The developing site of the gastric varices

The tabl. 2 shows the results of the 20 cases investigated carefully. The most of all gastric varices were found exclusively in the cardiac area. Also the study of the cardiac varices should be said definitely as the examination of the cardiac area. In proportion to the increased involvement in the cardiac area, the

Table 2. developing site of the gastric varices (20 cases)

in and around the cardia	20
fornix	14
greater curvature	9
lesser curvature	10
deformity of the duodenal bulb	6 cases

varices seem to appear frequently in the another area as well (14 cases in the fornx, 9 cases in the greater curvature, 10 cases in the lesser curvature). These findings also may be found in the anterior or posterior wall.

Differential diagnosis

Each of the general findings, detailed findings and the developing site alone may not be pathognomonic but may be more and more characteristic pattern of this condition by the summarization of these three findings.

If they were not observed in another part except the cardiac area, it has been said to be difficult to differentiate between the cardiac cancer and the varices in the cardiac area. But this may be chiefly based upon the ability how to demonstrate the detailed findings roentgenographically.

On the analysis of the detailed findings, it should be taken account of the mildly prominence of the folds and the alternations of its images.

Being demonstrated the en-face images sufficiently, it may be possible to diagnose definitely the gastric varices if ever the esophageal varices, the splenic enlargement and the signs of the portal hypertension do not exist.

Relationship between the esophageal varices and the gastric varices

As the reports of Sammuel and other, it is reasonably accepted from the patho-anatomical viewpoint that the gastric varices may be formed antecedent to the esophageal varices.

The frequency of the esophageal varices to the gastric varices: The formation of the varices in the digestive tract has been found mainly in the esophagus. In the begining, our radiological study of the portal hypertension was only X-ray analysis of the esophagus. By the improved X-ray technique in the cardiac regions, we have had some doubt about the usual opinions. On the roentgenological studies of the portal hypertension, we have found the 39 cases of the esophageal and gastric varices. All of these cases (including the giant rugae) showed some findings in the cardiac area. On the contrary, the tabl. 3 shows that the esophageal varices were not found in the 17 cases (being 56% to the gastric varices).

The esophageal varices alone without the gastric varices were not found in every cases. On the whole,

Table 3. Frequency of the esophageal varices to the gastric varices (39 cases)

grade of esophageal varices	++	+	-
Before 1964 (19 cases)	3	10	6
From 1965 (20 cases)	3	6	11
Total	6	16	17
(percentage)	(15%)	(41%)	(44%)
(++)	markedly in the all available films		
(+)	visible in the part of the available films		
(-)	no visible at all		

the grade of the esophageal varices may be nearly to that of the gastric varices. Either of the two are manifested more strikingly in not a few cases.

On the 12 cases complaining of the hemoptysis and hematoemesis: The gastric varices were found in the all, having the chief complaints of the bleedings from the digestive tract. The tumorous and polypoid types were found in the 10 cases which might be thought to occur the bleedings. On the other hand, the esophageal varices were observed in the 3 cases of high-grade, in the 7 cases of middle-grade and not at all in the 2 cases. It was thought that the bleedings at least in the latter two cases might be originated the gastric lesion.

Summary

- 1) It is difficult and dangerous to investigate the gastric varices by the endoscopical studies, and moreover the biopsy are out of the question. X-ray examination is most suitable for this condition.
- 2) It has been proved that the gastric varices may be formed more frequently antecedent to the esophageal varices.
- 3) If the one has been practiced roentgenographically in demonstrating the en-face images in the cardiac area, it is easy to correctly diagnose the condition. The above mentioned have been concluded basing upon this premise.
- 4) We have discussed the general and detailed findings of the 39 cases of gastric varices. Each of these findings itself may not be pathognomonic, but appreciating from the summarized viewpoint, these may become more and more characteristic.

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