SECTION IV—Roentgenology

Cascade Stomach: A Review

By

ROY UPHAM, M.D., F.A.C.S.
NEW YORK CITY, NEW YORK

A SURVEY of American literature on the subject of "cascade stomach" reveals scant mention of this condition. Cascade stomach has attracted far more attention in France, Italy and England than it has in this country.

DEFINITION

Cascade stomach is not a particular variety of "hour glass" stomach, as is considered by many, but is the result of a special change in form and position of the stomach. It has only one thing in common with hour glass stomach, that is, the division of the stomach into two parts. In cascade stomach there is a typical dilatation of the upper pocket with enlargement posteriorly into the upper posterior portion of the abdomen. It is characteristic of cascade stomach that the upper pocket is always larger than the lower pocket, and there is a distinct difference in the lumen. In hour glass stomach one pocket is situated above the other in a direct line, and there is an equal tonicity in both pockets, as well as nearly identical lumen outline. In cascade stomach the upper pocket lacks tonicity, the contents filling the upper pocket as though in a flaccid sac devoid of peristalsis. Hour glass stomach, in the lateral view under the fluoroscope, discloses but little posterior enlargement and displacement of the upper sac, and the anteroposterior diameter is a little in excess of the normal stomach; whereas, in cascade stomach there is a pronounced enlargement posteriorly of the upper sac, with the stomach far to the back of the abdomen. By a sudden change in the position of the patient the fluid contents in the toneless upper pocket can be made to change its level and a splashing is occasioned as of fluid in a cavity.

To Rieder (20) belongs the credit of first calling our attention to this condition in 1910, Assmann (1) giving him credit in his book "Die Roentgendiagnostik der Inneren Erkrankungen."

Le Wald (14) reports that he identified the condition as early as 1911 in a routine examination of some medical students at New York University and Bellevue Medical College. Le Wald termed the condition "shelf stomach."

Stierlin (23) reported the first two operations for cascade stomach in 1916. He found a callous ulcer at or near the lesser curvature with spasmodic indrawing of the greater curvature, producing deformity in each case.

Schlesinger (21) reported ten or twelve cases, finding some of the earlier instances of spasmodic cascade which disappeared with a resulting normal stomach. One of these appeared to be a reflex from duodenal ulcer, and an effort was made to parallel the condition of hour glass stomach, attention being called to the fact that there were intermittent forms in both and persistent forms in both. Schlesinger (21) endeavored to establish that intrinsic pathology might cause the condition, or that it might be a reflex from remote causes or conditions of the general nervous system.

Faulhaber (9) previously had had two cases, one of which clinically was diagnosed as gastric ulcer with hemorrhage, but at operation no ulcer was found. This case undoubtedly belongs to the type of cascade stomach which will be discussed in detail later in this article, and which is not due to intra-gastric pathology. In Faulhaber's (9) second case there was an ulcer with involvement of the pancreas, and in this case the pathology undoubtedly agrees with what is to be stressed by the writer later in this article.

Schutze (22) first distinctly reported the balloon form of the upper sac, which is characteristic of the condition. He was the first to emphasize the characteristic deformity with displacement upward of the left crus of the diaphragm, with concomitant displacement of the heart due to the dilatation of the fundus of the stomach by the fluid and gas contents. The constant upward displacement of the left crus of the diaphragm shows the excessive pressure produced by the obstruction, and at once confirms the hypothesis of a pressure-destruction of the fat in the upper left quadrant of the abdomen, further evidencing the pressure which may be exerted on the spleen, the colon, and the kidney—structures normally occupying the upper left quadrant of the abdomen. Comparing the upward pressure on the diaphragm with the hour glass, it is evident that only the nearly complete organic malignant obstruction could cause such a displacement of the left crus as is seen in nearly every case of cascade stomach. Therefore the deduction must be that the obstructive features of the cascade are of a very pronounced and obstinate character. Schutze seems to have had a particularly large experience with the condition, as he reports thirty to forty cases, and classes the deformity as dependent upon an anatomical basis.

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Laurel (13) made a contribution when he drew attention to the transitory forms as differing from the true cascade stomach of pathological significance. In the course of routine methods of investigation the writer has observed the spasmodic type with a fair degree of frequency; and if the etiology of the spasmodic type is that suggested by Barclay, (2) namely, a spasm of the oblique muscle of the stomach drawing the stomach up, it can readily be understood how such a transitory cascade can occur. Laurel (13) considers this as a normal cascade form of stomach in contradistinction to the cascade form produced by a gas-filled colon, either through pressure which causes the stomach to ride above (which etiology is not complete, although it may be a partial element), or by traction of the colon. There is a cascade stomach of pathological significance; the cascade caused by gastric ulcer with cicatricial or cord formation, and cascade stomach due to malignancy.

Assmann, (1) in his work on radiographic diagnosis, agrees that gaseous distension of the splenic flexure of the colon is a significant etiological factor. In one of his cases there was marked distension of the splenic flexure of the colon, and at post mortem the stomach was found to be normal. In another case there was a diaphragmatic hernia with extreme gaseous distension of the colon, the result of tubercular peritonitis. Later, this case presented a normal stomach. In a third case of cascade stomach occurring in adhesive peritonitis, at autopsy the stomach was found to be normal.

Barclay of England, (2) in presenting the name "cup and spill" stomach in 1921, brought forward the suggestion of a spasm of the oblique muscle fibers as an etiological factor.

The cases reported by Stupel (24) all depended upon recognized pathology. His first case presented a tumor in the left hypochondrium, which was reduced by x-ray treatment, and the stomach returned to normal appearance. In his second case there was a congenital transposition of the caecum and ascending colon to the left with a chronic appendix. His third case had a diaphragmatic hernia on the right side, with upward displacement of the colon and liver.

Wilucki (27) brought to the point that extravesicular tumor in the region of the splenic flexure may act as a causal factor. He, also, was at a loss to explain the etiology, believing that spasm from gastric ulcer or reflex spasm from duodenal ulcer, or adhesions involving the stomach, could be a cause. There was also an extrinsic factor, such as gas in the colon. He particularly stresses the cicatrix of healed ulcer and the deformity of malignancy as intravesicular causes.

Feissley and Fried (9) reported a case in a woman of fifty years who was operated upon twice, and still the cascade continued. At the first operation a short meso-colon was found, also a short hepatogastric ligament, and it was felt that the shortness of the ligament and adhesions about the gall-bladder explained the cascade stomach. After operation symptoms returned and two months later she was operated upon again with the same findings, except that the drawing up of the stomach was more pronounced. Neither atropin nor papaverin was of any avail. At the second laparotomy the findings were: omentum adherent to the abdominal wall, liver and surrounding structures; colon and gastro-colic ligament drawn upward. The operation consisted of loosening the adhesions and liberating the colon and liver. A month later x-ray examination revealed that the cascade stomach was still present. The authors felt, in this case, that spasm could be excluded, as neither atropin nor papaverin had any effect. They believed aerophagy was a factor in distending the fornix of the stomach.

Webster (26) reported two cases, the first of which improved under medical treatment, and appeared to be of the spasmodic variety. His second case was one of extreme size of the two segments of the stomach, and was not affected by belladonna. At operation the stomach was found to be normal with extreme gaseous distension of the entire colon. There was a healed duodenal ulcer, and a gastroenterostomy was performed—the results not being definite. Webster also stresses the factor of spasm of the oblique muscle fibers.

Matthes (15) claims that the condition is the result of combined regional and diffuse spasticity of the stomach, and may be due to an ulcer on the lesser curvature at the seat of the spasm; that it also is encountered as the result of an enlarged spleen with gas in the splenic flexure of the colon and transverse colon, and from duodenal ulcer, and he emphasizes the fact that at times it may be due purely to spasm.

Ratkoczzi (16) feels that the cascade stomach is actually a roentgenological conception, stressing that it is not a special variety of hour glass stomach. The contrast meal forms in a high-lying, bowl-shaped sac which is very much larger than the tube-shaped lower part, which later becomes filled from the upper sac, the entire meal frequently remaining for minutes before it empties into the distal part. In hour glass stomach the upper sac is usually small and the greater part of the meal flows uninterruptedly into the mostly flaccid, but at all events larger, distal part of the stomach. Various peritoneal adhesions may give rise to peculiar changes in the shape of the stomach, but never give rise to changes in size and shape such as the cascade stomach. High up, immediately below the diaphragm and more dorsally in the lower part, lies the larger bowl-shaped part of the stomach, in which the greater part of the meal gathers following ingestion. To the right, and in front, comes the hose-shaped distal part, the direction being from behind and from the left towards the right. The central part, near the pylorus, unfolds slowly, and fills with an appearance of an elephant's trunk. The fact that the lower part of the stomach lies to the right can best be seen in the lateral position. As regards the etiology, he emphasizes more the question of the distension of the splenic flexure, but claims in cases of pressure by the splenic flexure the changes must be passive ones, and feels that the entire nature of the cascade stomach is against a passive concept. The shape of the cascade stomach is too variable, and changes too quickly.

Ratkoczzi (16) refers to some experiments that were carried out by Schlemmer of Budapest, in which he inflated the colon and produced a type of cascade stomach, but only in cases where there was pathology in or about the stomach, never where the stomach was normal. In taking issue with the hypothesis of dam-