ability to improve the inhibitory effect of lactic, acetic and hydrochloric acids.

The bacteriostatic effect of pectin seems to vary with its source. Apple pectin is just as effective at a pH of 4.6 as citrus pectin is at a pH of 4.36. The fact that pectic acid, a purer form of pectinous material than pectin, is ineffective at a pH of 4.6 (although the amount of pectic acid required to produce a pH of 4.6 is less than that of apple pectin) while apple pectin is, would seem to indicate that the effectiveness of the latter material was due to some attached substance. At a pH of 5, apple pectin had lost some of its effectiveness while "non-acid pectin" was quite potent although an amount smaller than that of apple pectin was required to produce a pH of 5.0. It would seem therefore that the effectiveness of "non-acid pectin" and apple pectin is largely a matter of pH, the former having its maximum activity at a pH of 5.0 and the latter at a pH of 4.6. When the various pectin preparations were made up in a two per cent solution, "non-acid pectin" produced the lowest pH (4.36). When these solutions were brought to a pH of 4.85 and 5.0 by the addition of $K_2HPO_4$, more had to be added to the "non-acid pectin" than to apple pectin. Nevertheless, in all instances, the bacteriostatic effect was lost. Adding enough phosphate buffer to produce a pH of 5.0 caused even a greater loss. This is a striking effect when it is recalled that "non-acid pectin" at a pH of 5.0 was very effective as a bacteriostatic agent. The explanation of this effect is not apparent unless it be connected in some way with the effect of the potassium or phosphate ions upon the active part of the pectin complex.

The fact that "non-acid pectin" is most effective at a pH of 5.0 and apple pectin at a pH of 4.6 indicates the possibility that the active factor associated with pectin is not the same in both instances. Furthermore, the effectiveness of "non-acid pectin" (nickel pectinate) at a pH of 4.36 was not as great as that of apple pectin at a pH of 4.6. The effectiveness of apple pectin at various hydrogen-ion concentrations deserves more study.

## SUMMARY AND CONCLUSIONS

1. Of the organic acids present in the intestinal contents of animals fed fruit supplements, butyric acid has the greatest bacteriostatic effect.
2. The bacteriostatic action of butyric acid is not entirely dependent upon the hydrogen-ion concentration.
3. Bactericidal action of the pectins vary with their composition, and the pH of the medium.
4. "Non-acid pectin" was found to be bactericidal at a pH of 5.0-5.5 but the other pectins tested were not.
5. As the pH was lowered to 4.6 apple and citrus pectin became more bactericidal than the "non-acid pectin."
6. Pectic acid was less inhibitory than pectin at the same pH.
7. Solutions of the various pectins brought to a pH of 4.85 and 5.0 by $K_2HPO_4$ lost their bacteriostatic effect.
8. Dehydrated apple powder has no bactericidal or bacteriostatic action at a pH as low as 4.6. The removal of alcohol soluble materials from the apple did not improve the anti-bacterial effect in vitro.
9. The possibility is discussed that the bactericidal effect of such food materials as the apple in the intestine is not so much due to substances contained in them as to factors derived from them by enzymic action. There remains in addition the possibility that certain inorganic elements present may be effective and that pectin under certain conditions such as an optimum pH may exert an inhibitory or destructive effect upon bacterial growth.

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# Aneurysm of the Abdominal Aorta*

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ANEURYSM of the abdominal aorta is a relatively rare condition. It was first described by Vesalius (1) in 1557. A survey of the current literature on this subject reveals a number of single case reports and a few reviews. The incidence of this condition in hospital records is extremely low, ranging about 0.035 per cent. The necropsy incidence however is much higher, ranging about 0.173 per cent. The abdominal constitute 11.8 per cent of all aneurysms. The total number of reported cases is less than 500. Nixon (2) in 1911 collected 233 cases, and Kampmeier (3) in 1936 brought the number up to 381.

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The majority of cases occur in the negro race, because of their high incidence of syphilis. In 335 cases there were 292 males and 43 females.

Three types of aneurysms are recognized; the saccular, fusiform and dissecting. In 34 of 38 cases of abdominal aneurysm, Lucke and Rea (4) found that 30 were saccular, 3 fusiform and 1 of the dissecting types. Aneurysmal sacs vary in size, may be either small or large. The majority, however, are quite large when recognized. An unusually large sized tumor mass may at times be visible on inspection of the abdomen. The ability to disclose the aneurysmal mass varies according to its size and position. When the

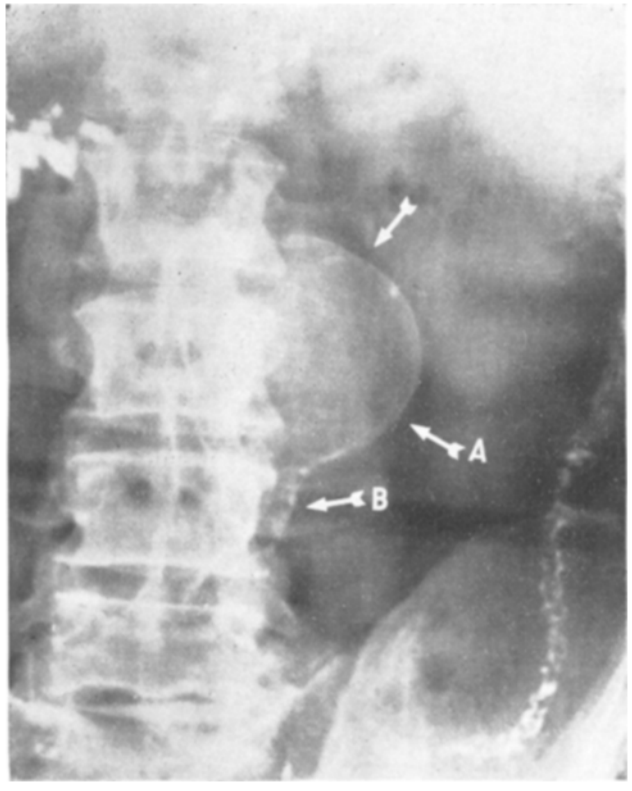


Fig. 1, Case 1. A 24 hour gastro-intestinal roentgenogram demonstrating an abdominal aneurysm situated mesially, adjacent the 2nd and 3rd lumbar vertebra at arrows A. Note the calcification of the abdominal aorta at arrow B. The psoas muscle is clearly visible, can be seen through the sac.

aneurysm arises from the anterior wall of the aorta, the tumor mass is detected by its expansile, pulsating characteristics, while those arising from the posterior wall present greater difficulty in palpating, except when they are very large in size. In our two cases, one was very small and not palpable, the other was very large and palpable. The mass is frequently expansile, a sign which is more or less pathognomonic of this condition. According to Osler (5), the presence of an expansile tumor mass in the abdomen justifies a diagnosis of an abdominal aneurysm. However, it must be emphasized that all aneurysms do not pulsate, and one must rule out the possibility of transmitted pulsations.

Aneurysms may occur in any portion of the abdominal aorta. They are most commonly observed in the upper segment of the aorta near the celiac axis. The site of the aneurysmal mass is usually limited by the vertebra and liver, so that nearly all abdominal aneurysms are situated on the left side.

Calcification of the abdominal aorta and calcification of the aneurysm may be observed in some instances. The calcified plaques may outline the aneurysmal sac clearly. In Kampmeier's 68 cases only 3 revealed a calcification of the sac of the aneurysm. In 80 cases of intra-abdominal aneurysms of all types, Mills and Horton (6) found 5 instances with calcified deposits in the aneurysmal sac.

A highly important and not uncommon roentgen finding in this condition is the erosion of the vertebra by pressure of the aneurysmal sac upon the spine. The number of vertebra involved vary, but two or more bodies are commonly affected. The region most often involved lies between the 12th dorsal and 3rd lumbar vertebra. The 12th dorsal and 1st lumbar vertebra are the two most often involved. An interesting phenomenon, characteristic of this condition is the lack of involvement of the intervertebral disc. The disc is rarely affected in the erosive process until very late in the course of the disease. The absence of disc involvement produces a characteristic pressure deformity of the bodies of the vertebra in the form of a saucer-shaped mid-portion or scalloping. The superior and inferior margins of the body adjacent to the discs are usually intact. The erosion is smooth and clear-cut and varies from a slight pressure defect on the anterior surface to an extensive deformity involving as much as one-half of the body of the vertebra. Ordinarily the erosive process continues until a deep excavation is made producing a crescent shaped deformity. It has been pointed out that the preservation of the disc is attributed to the resiliency of the cartilage. The incidence of spinal involvement varies, but it is said to be quite large. In 24 of Kampmeier's 68 cases in which studies of the spine were made, 18 or 75 per cent of these yielded evidence of erosion of the vertebra. Vertebral erosion may be so marked as to cause compression of the spinal cord. Gregory (8) emphasized that compression of the spinal cord as a complication of abdominal aneurysm has received but too little attention. Weingrow and Bray (9) report a case of abdominal aneurysm in which lipoidol injected

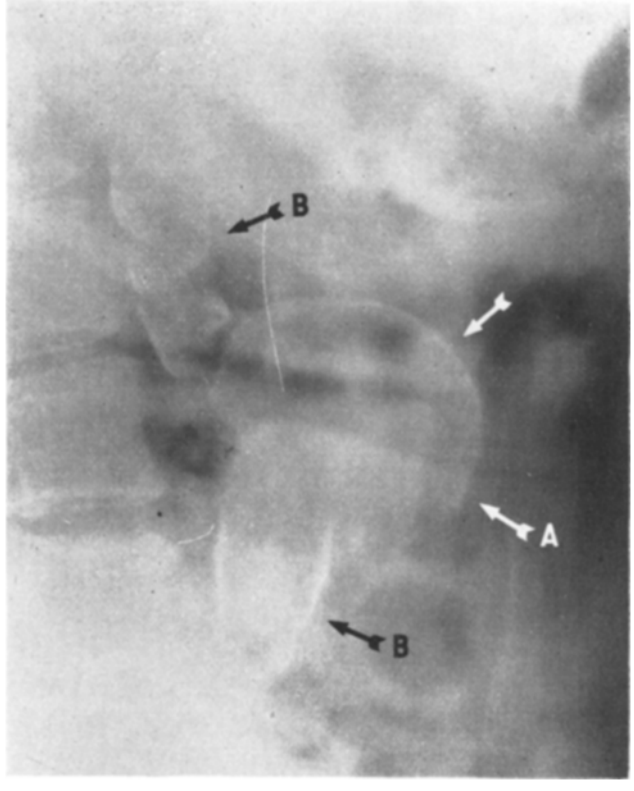


Fig. 2, Case 1. Lateral view of abdomen, the aneurysmal sac is shown at arrows A. Calcification of the abdominal aorta is demonstrated at arrows B (retouched). The lumbar vertebra do not show evidence of pressure erosion.

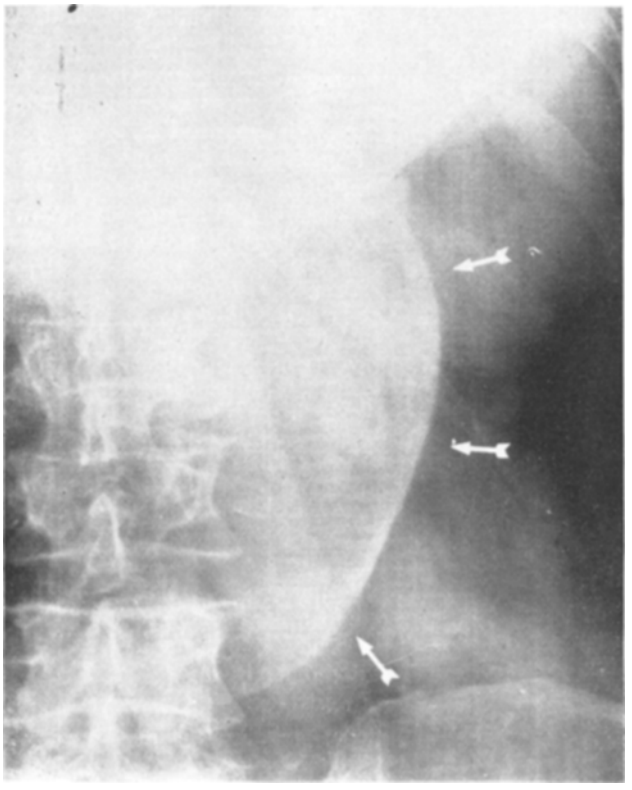

Fig. 3, Case 2. Demonstrates a large fusiform abdominal aneurysm in a preliminary roentgenogram made in the supine position. The sac extends from the 12th dorsal vertebra to the 4th lumbar vertebra (retouched). Note the psoas muscle is clearly visible.

into the spinal canal revealed an obstruction due to pressure.

Pressure deformities and bone erosion of the lower left ribs and also separation of the ribs have been noted in some cases of abdominal aneurysm. Farmer (7) directs attention to signs of rarefaction of the lower left ribs and also the transverse processes of the left side of the lumbar vertebra as the result of pressure.

Abdominal aneurysm frequently terminate by retroperitoneal and intraperitoneal rupture. It may, however, rupture into the abdominal viscus. Rarely it may rupture through the diaphragm into the pleural cavity. Such instances were reported by McClure (10), and by Croly and Graves (11). A ruptured aneurysm may in rare instances produce an intestinal obstruction. The necropsy incidence of rupture of abdominal aneurysms vary. The following table presents the incidence in a large series of autopsy cases.

| | Autopsy Cases | Rupture | Rupture Into Duodenum | Rupture Into Abdominal Viscus |
|---|---|---|---|---|
| Neely (12) | 1,385 | 5 | 1 | |
| Kampmeier (3) | 381 | | 4 | 10 |
| Nixon (2) | 233 | 149 | | 3 |
| Marlow and Doubler (13) | 244 | | | 5 |

Owing to the close proximity of the duodenum to abdominal aneurysms, rupture into this portion of the intestine occur with greater frequency than in other parts of the gastro-intestinal tract.

Clinically the condition manifests itself variously. It may not produce any clinical manifestations whatsoever, but on the other hand, may cause considerable abdominal distress, depending upon the amount of pressure on the neighboring organs. It is interesting to note that of the 80 cases of intra-abdominal aneurysms reported by Mills and Horton, gastro-intestinal symptoms were present in only 7 instances or 8.08 per cent.

## CASE REPORTS

During a period of five years two cases of abdominal aneurysm were encountered at the Sinai Hospital. A brief report of these two cases is presented.

Case 1, S. P., male, aged 63, complained of pains in both arms and legs with some difficulty in walking. He also complained of genito-urinary symptoms, such as dribbling and incontinence. There was evidence of a chronic myocarditis and cardiac insufficiency. There were no clinical manifestations that indicated the presence of an abdominal aneurysm. There was a prostatic benign hypertrophy. Studies of the kidney including pyelographic examination yielded evidence of a hypernephroma of the right kidney. The Wassermann test was negative. A routine roentgen examination of the gastro-intestinal tract showed a small 5½ hour gastric residue, otherwise nothing abnormal was found. The gastro-intestinal films showed a shadow in the left upper quadrant situated mesially, close to the spinal column. A lateral view showed the mass connected with a calcified abdominal aorta. The aneurysmal sac also revealed evidence of calcification. The

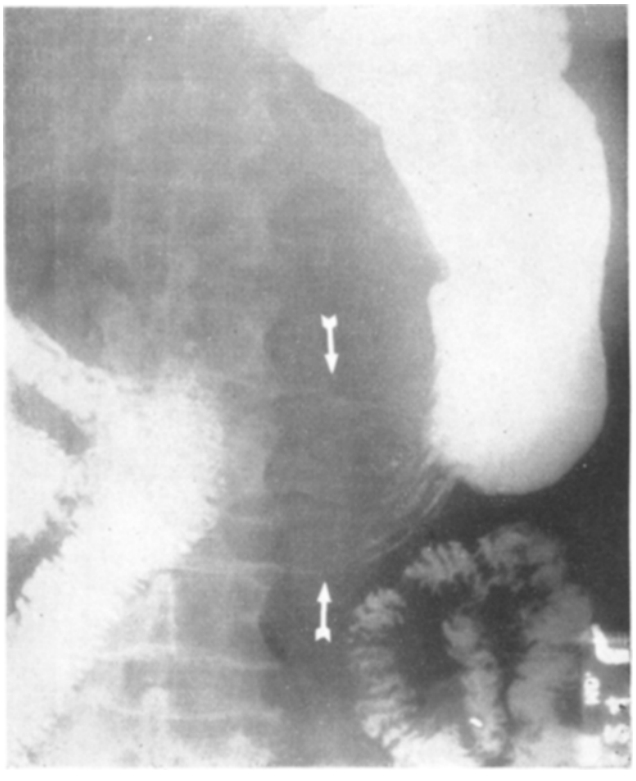

Fig. 4, Case 2. Roentgenogram of the stomach illustrating a large pressure defect, compressing the pyloric portion of the stomach. Note the mucosa rugae are not effaced. The stomach is displaced toward the left side.

small aneurysmal mass was not palpated. A roentgen diagnosis of abdominal aneurysm was made.

Case 2, R. G., female, aged 74, referred to the Sinai Hospital by Dr. A. L. Hornstein. She presented marked hypertensive cardiovascular disease with cardiac insufficiency and hypertrophy. Her blood pressure was 190/136. Wassermann test was negative. Examination of the abdomen revealed a large mass, palpated on the left side mesially. This mass was not definitely expansile. A gastro-intestinal roentgen study revealed a large filling defect in the pyloric portion of the stomach. The rugae in the defective area was not entirely effaced. The defect was definitely due to pressure from an extrinsic mass. There was also a duodenal diverticulum. A roentgen diagnosis of an extrinsic mass causing pressure upon the stomach was made. A preoperative diagnosis of a possible abdominal aneurysm was made by Dr. T. S. Cullen.

## DIAGNOSIS

The diagnosis of abdominal aorta aneurysm is frequently attended with great difficulty. It should be considered in all retroperitoneal tumors, especially those arising on the left side and mesially. The condition may elude discovery in spite of a thorough investigation. A preliminary roentgenogram of the abdomen made in the supine position will often reveal an aneurysmal tumor mass adjacent to the spinal column. At times calcareous plaques in the wall of the sac will clearly outline the aneurysm. Fluoroscopic examination may disclose a fixed mass when palpable, which does not move with respiration. The mass is adherent mesially and is not connected to any of the radiable organs. The mass may be seen to pulsate at times. The psoas muscle is not generally obliterated in the uncomplicated case, but in cases of retroperitoneal hemorrhage or rupture, the outline of the psoas muscle may be obscured. The left kidney may be displaced peripherally to the left. In cases of rupture retroperitoneally, the kidney outline may be obscured. If rupture has occurred, a diffuse density may be seen in the retroperitoneal space. If the aneurysm is located high up under the left diaphragm it may be brought out in relief by the air bubble in the stomach or air in the colon. A lateral view of the spine will often disclose the typical scalloped appearance of the vertebra.

A gastro-intestinal examination will frequently reveal signs of extrinsic pressure in the stomach. The stomach may be displaced toward the left side and anteriorly. The left colon may also show evidence of pressure and downward displacement when the tumor sac is very large. The pressure defect and displacement of the stomach depends upon the position and size of the aneurysm. When the aneurysm is situated in the upper segment of the abdominal aorta, pressure changes in the stomach are more apt to be observed, while those that occur in the lower portion of the aorta do not as a rule produce gastric pressure. A gastro-intestinal fluoroscopic study may occasionally reveal abnormal transmitted gastric pulsations, due to the pulsating aneurysm against the wall of the stomach. There is often pressure on the third portion of the duodenum. Washburn and Wilbur (14) point out that obstruction of the 3rd portion of the duodenum is relatively common. The aneurysmal mass does not as a rule move with respiration and when situated close to the diaphragm, may be seen to separate from it.

A roentgenogram of the chest may disclose an elevation of the left diaphragm and heart shadows as a result of pressure from below. In the case of a spurious aneurysm Kjellberg (15) points out that a rounded hernia-like protrusion of the posterior portion of the diaphragm may simulate a neoplasm. Various special roentgenographic procedures have been recommended in order to better demonstrate the aneurysmal mass. Spangenberg, Munist and Letjman (16) advocate the use of aortography by the injection of an opaque medium into the aorta in order to outline the sac. Pneumoperitoneum has also been used by some as an aid in outlining the aneurysm. Air insufflated into the colon may in some instances bring out in relief an aneurysmal sac.

## SUMMARY

Aneurysm of the abdominal aorta is a relatively rare condition. In a period of five years only two cases were observed. The condition may be diagnosed roentgenologically in a large percentage of cases. The roentgen criteria of a tumorous sac formation, calcium deposits in the sac, retroperitoneal mesial position of the tumor, a mass demonstrated to be outside of the gastro-intestinal organs, which cause pressure and displacement of the stomach; pressure erosive defects of the vertebra and an expansile tumor mass, are signs of aneurysm of the abdominal aorta. Two cases are reported with a survey of the literature.

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