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A NEW METHOD TO RECORD INTESTINAL SOUNDS

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Abstracts

In abdominal surgery the intestinal sounds is the most practical index of the recovery in the postoperative condition of the intestine. The purpose of this study is to analyze the intestinal sounds from the clinical view point and to obtain the new, more precise interpretation than hearing with stethoscope. We used the RS-200 S type phonometer for the recording. We called this method the intestinal phonography (I. P. G.). About 120 cases were examined to study the relation between the abdominal gas volume, meal, operation and intestinal sounds.

INTRODUCTION

The intestinal sounds are produced by the intestinal movement and gas in the canal. Thus, intestinal sounds lack regularity and rhythmicity such as cardiac sounds. The most difficult thing is that animal study is ineffective as intestinal sounds are affected by anesthesia. Furthermore, some interfering noise was also recorded with intestinal sounds. Such a difficulty has made it impossible to interpret the intestinal sounds clinically. In our series, simultaneously ordinary auscultation and phonocardiometer recordings were made by the use of a modified RS-200 S type phonocardiometer. By this simultaneous method, cardiac noise, respiratory noise and other interfering noise could be differentiated from intestinal sounds.

METHODS

The methods of recording and the exclusion of extraperitioneal noise

(A) The recording equipment and its adjustment

We used the modified RS-200 S type phonocardiometer. This equipment was adjusted as follows. Paper speed was 25 mm per second,

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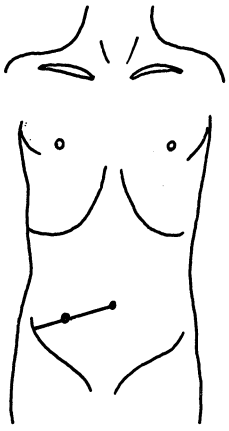
sound range was 160 cycle and sensitivity was 24 oct.-16 deb. These conditions were adequate to register intestinal sounds. By this simultaneous method, we could exclude cardiac noise, respiratory noise and noises from the abdominal wall (Fig. 1).



(1) Recording equipment
RS-200 S type phonocardiometer which is adjusted as follows: 9.5 deb., medium range, paper speed of 25 mm per minute.

(2) Recording point
Midpoint between umbilicus and right anterior iliac spine.

(3) Preparation of patient
IPG was recorded after 3 to 5 hours fast.

Fig. 1. The recording equipment and its adjustment

At first, extraperitoneal noise pattern was recorded for the differentiation.

(B) The pattern of the extraperitoneal noise

(1) The diminution of cardiac noise

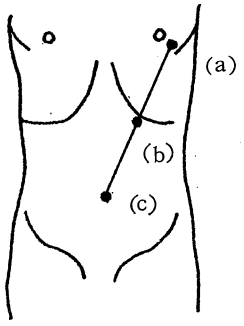
We recorded cardiac noise at points a, b and c. Cardiac apex was supposed to be the point (a). Umbilicus was supposed to be the point (c). The midpoint between the points (a) and (c) was supposed to be the point (b). As shown in the phonogram, the cardiac noise diminished gradually from the point (a) to (b), and at the point of umbilicus the cardiac noise was not registered (Fig. 2).

(2) Respiratory noise

When microphone was placed on the abdominal wall to register the intestinal sounds, respiratory friction noise was recorded as shown in illustration. This respiratory noise pattern consisted of numerous spikes and appeared as a broad line of which the center was widest. This pattern had a regular rhythm, which differed from intestinal sounds.

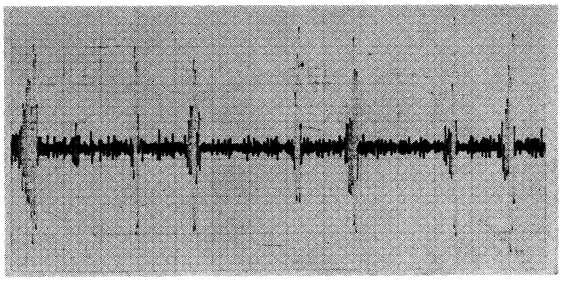
(3) Scratching noise on abdominal wall

This pattern consisted of short, spindle-shaped spikes.

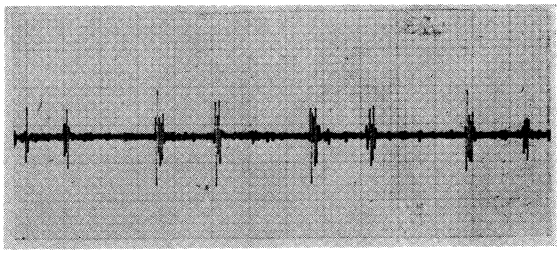


(9.5 deb., medium range, paper speed of 25 mm/sec)

(a) cardiac apex



(b) midpoint between heart and umbilicus



(c) umbilicus

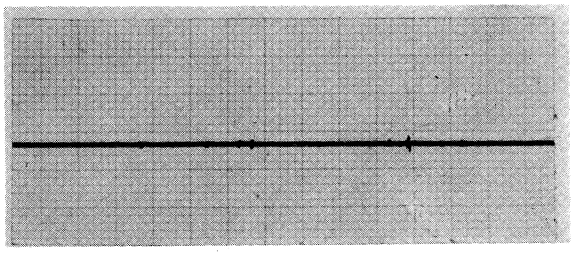


Fig. 2. Diminution of the cardiac noise in abdomen

(4) The percussion noise on abdominal wall

This noise consisted of sharply elevated spikes of 13 mm height. Those of (2), (3) and (4) could easily be excluded from intestinal sounds by pattern (Fig. 3).

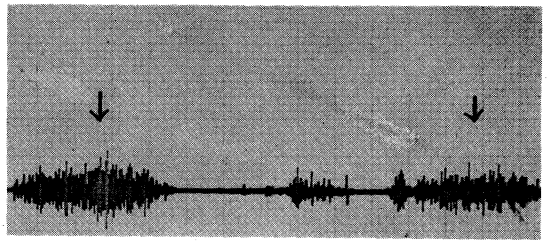
(C) Registration of intestinal sounds without stimulation

(1) Recording equipment

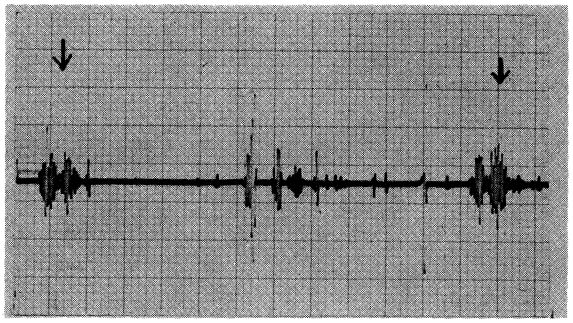
Recording was performed by the use of a modified RS-200 S type cardiac phonometer after adjustment as follows: 9.5 deb., medium range, paper speed of 25 mm per second.

(9.5 deb., medium range, paper speed of 25 mm/sec)

Respiratory noise



Scratching noise on abdominal wall



Percussion noise on abdominal wall

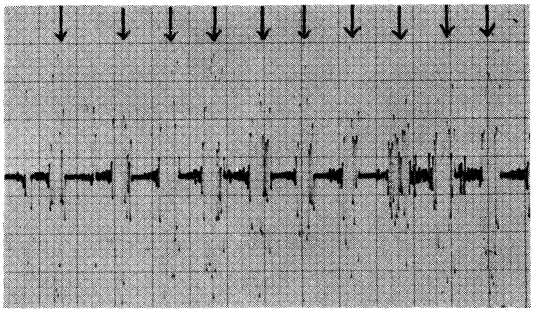


Fig. 3. Noise in recording of the I. P. G.

(2) Abdominal part for registration

Midpoint between umbilicus and right anterior superior iliac spine was suitable point for the microphone because this point was free from the cardiac noise and respiratory movement.

(3) The condition of patient

Patient should be examined after 3 to 5 hours' fasting because the intestinal movement and sounds become settled.

RESULTS

[I] The relation between abdominal gas volume and intestinal sounds

Intestinal sounds was registered in 20 cases of patients and flat films were taken at the same time. These patients had a certain laparotomy later and no abnormality of the intestinal tract was found.

(A) The methods to compare the abdominal gas volume and intestinal sounds

After a tracing paper was put on the x-ray film, the gas shadow was traced on the film with a pencil. The marked tracing paper was cut out with scissors. The weight of paper was measured. As the intestinal loop was almost a cylinder in shape, the paper weight was directly related to the gas volume. The calculated gas volume in the abdomen ranged from 63 to 472 cm^3. On the other hand, the recorded spike counts ranged from 15 to 95 per 10 seconds. This result indicated that no relationship was present between abdominal gas volume and spike counts. Consequently the simple x-ray film of the abdomen did not show the intestinal function and motility precisely[1], so that, intestinal phonogram was more reliable about the motility of intestine. This was one of the reasons for the use of intestinal phonogram recording (Fig. 4).

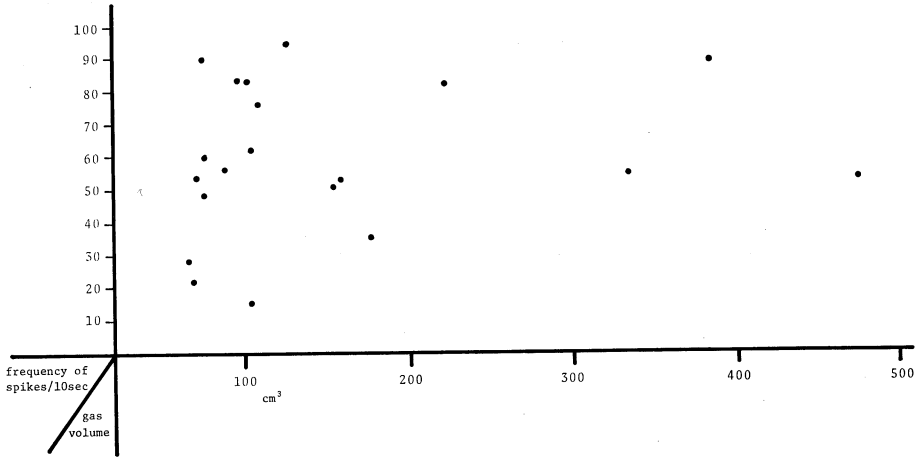


Fig. 4. The relation between intestinal gas volume and frequency of intestinal sounds

[II] The comparison of intestinal sounds between before and after a meal

We examined 20 healthy students to compare intestinal sounds between before and a after meal.

(A) The frequency of spikes before a meal

Students rested on bed 3 hours after eating and first intestinal sounds was recorded at the midpoint between umbilicus and anterior superior iliac spine. This result was that all the spikes were below the frequency of the 20 per 10 seconds. Intestinal sounds was again recorded at 30 minutes after a meal.

(B) The stimulation ratio of the intestinal sounds by a meal

The frequency of the 2 mm height was not changed before and after a meal. The stimulation ratio by a meal was about 2 times at 3 to 10 mm height of spike, and 1.5 times at the 11 to 15 mm height of spike. At the 16 mm height of spike, the frequency counts did not increase (Fig. 5).

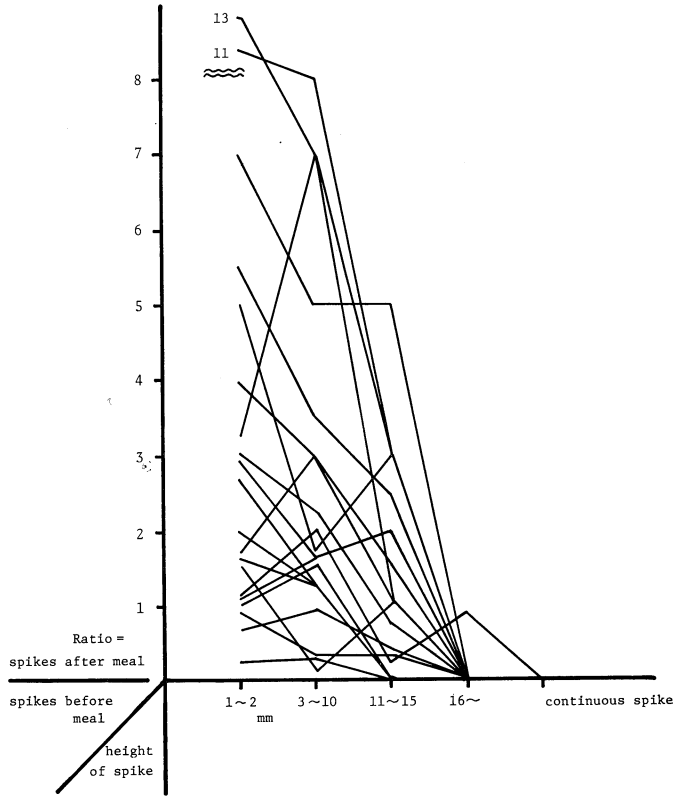


Fig 5. The stimulation ratio of intestinal sounds by a meal

[III] Clinical cases and their intestinal phonograms

(1) Diarrhea

Intestinal sounds of the patients with diarrhea were recorded. The phonogram showed the five times frequency of spikes than normal state in 10 seconds and some 0.4 second continuous spike, which was not seen in the normal state. The continuous spike in diarrhea also differed from the spike of intestinal stenosis by the shape of spike. In the continuous spike of diarrhea, the height of spikes varied as low and high but in the stenosis they were almost the same height of spikes. The height of spikes in diarrhea was not beyond the 20 mm height, but in the stenosis it was over 20 mm (Fig. 6).

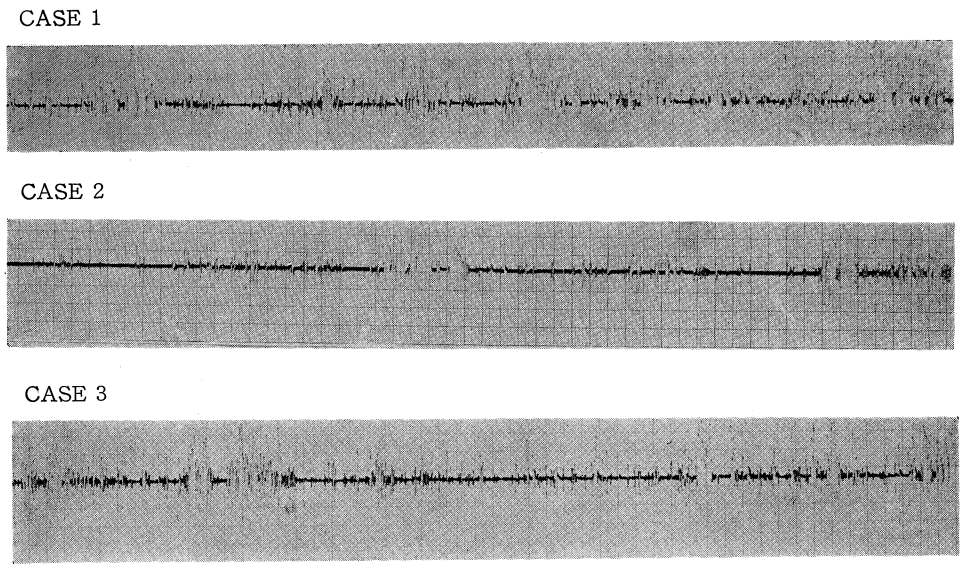


Fig. 6. Three cases of diarrhea

(2) The change of the spike before and after operation

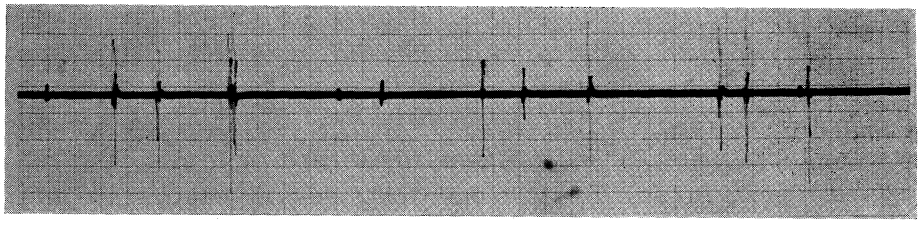
So far, the flatus had been observed in general as if the signal for the beginning of the oral feeding. But in postoperative course, no direct relation was seen between flatus and functional recovery of intestine.[2)]

(a) The change of the height of spike

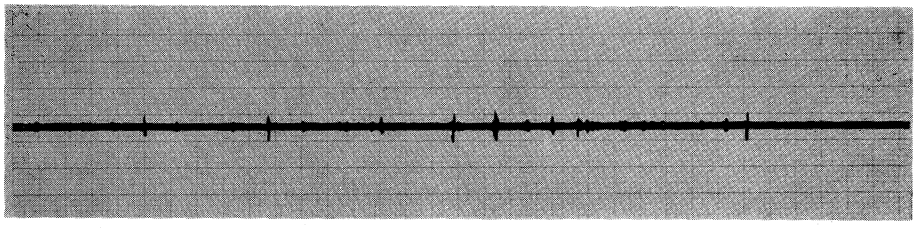
The phonogram of intestine after 3 hours fast prior to operation showed the 3 to 8 mm amplitude single spikes. Phonogram taken at 24 hours after the operation showed spike amplitudes below 5 mm and of a low frequency. The phonogram at 48 hours after the operation showed

spike of 18 mm height, which was almost the same amplitude as before the opration. At this time flatus passed (Fig. 7).

Before operation



At 24 hours after operation



At 48 hours after operation (after passing gas)

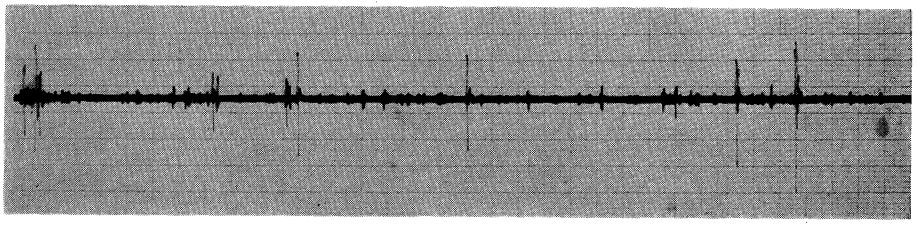


Fig. 7. Change in spikes before and after operation

(b) The change of frequency counts of intestinal sounds before and after the operation

The twenty patients with a certain laparotomy was examined of the recovery of the intestine after the operation. The frequency counts of the spike was shown on the graph. In the first 24 hours, the frequency of spike was lower by 80 % than before the operation in all the cases but 2 or 3 days after the operation the frequency of spikes was again increased up to 80 % of normal state and at this time flatus passed (Fig. 8).

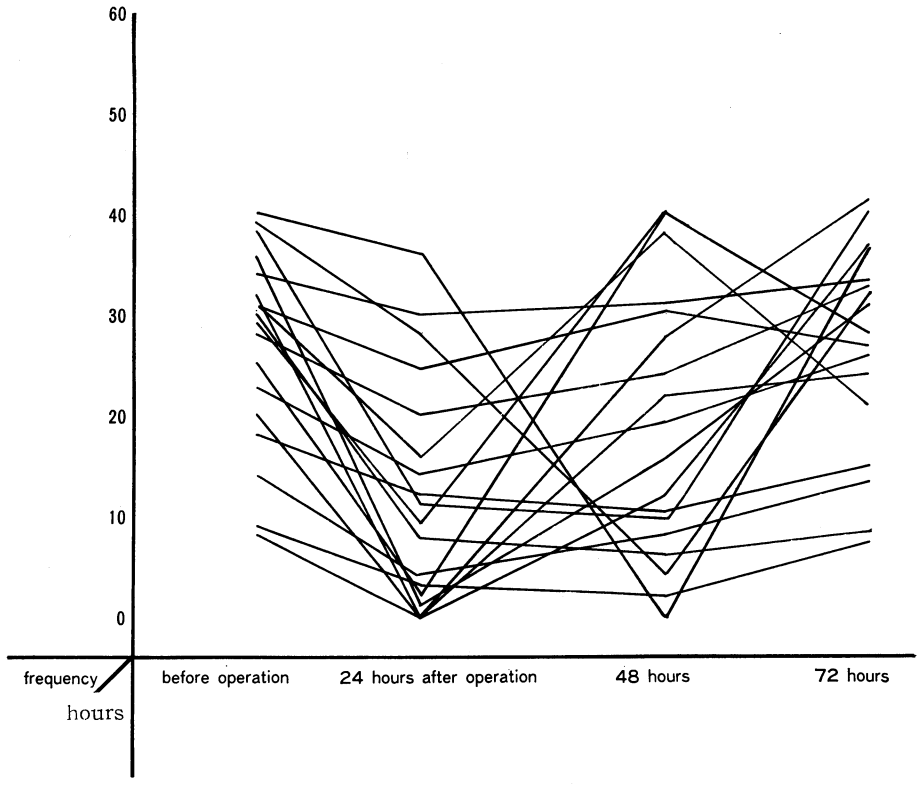


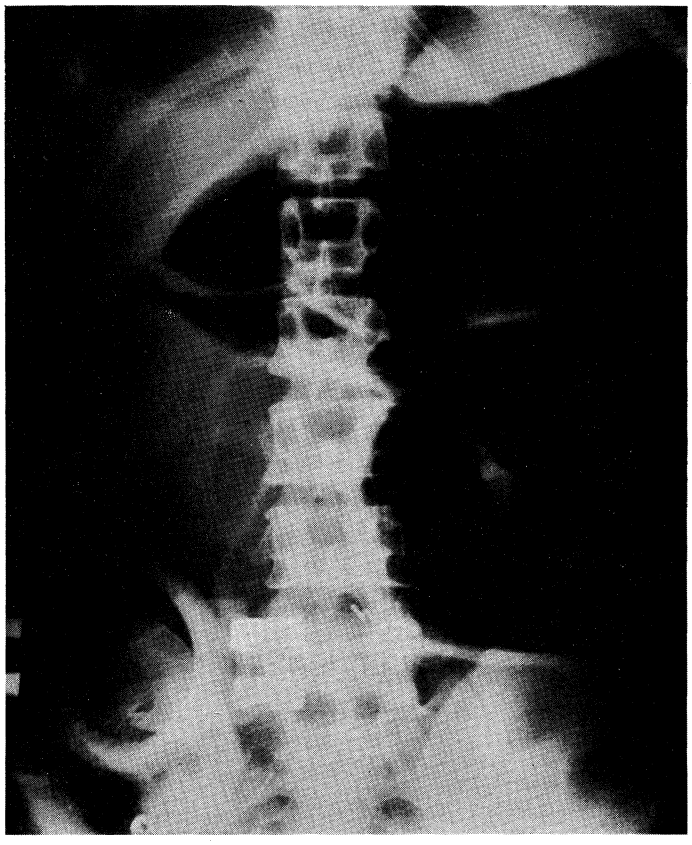
Fig. 8. Frequency of intestinal sounds before and after operation

(3) Chronic ileus due to adhesion

This patient was 48 years old male and he had the operation of ileal conduit 3 years ago. After this operation he suffered from chronic ileus. Flat abdominal film showed numerous air fluid levels. Simple intestinal phonogram was registered. It demonstrated the continuous spike, consisting of same height of spikes (Fig. 9).

(4) Intestinal obstruction in the rectal cancer

The patient was 58 years old. He was admitted with abdominal distention. Abdominal flat film revealed dilatation of the colon and many air fluid levels. A simple intestinal phonogram was recorded, showing continuous spikes. The obstruction due to rectal cancer was found at operation (Fig. 10).



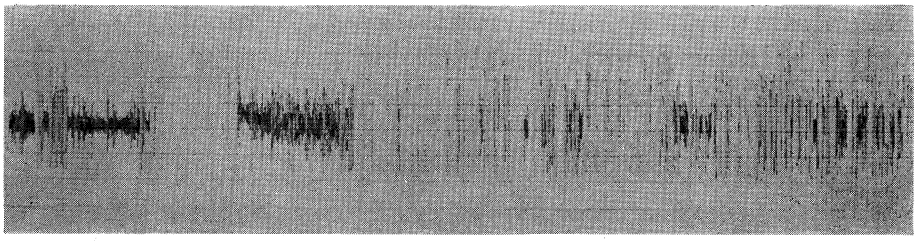
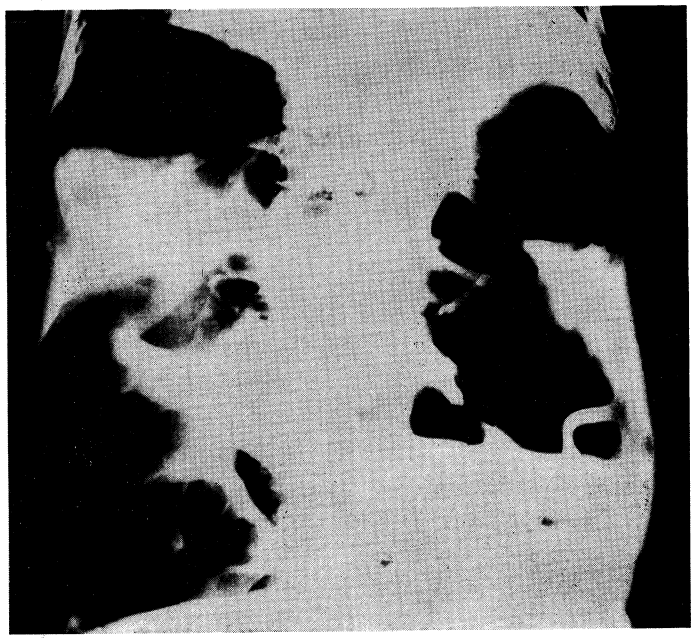


Fig. 9. A case of chronic ileus due to adhesion



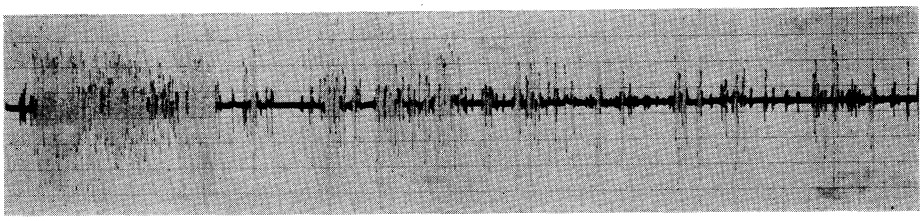


Fig. 10. Intestinal obstruction in the rectal cancer

DISCUSSION

In 1905, Cannon reported the results of the auscultation of the rhythmic sound produced by the stomach and intestines[3]. Recently, new reports of the intestinal sounds had been very few. But in 1974, Nakao et al. reported the cases, concerning the recovery process of intestinal sounds after abdominal surgery[4]. In our study, we differentiated intestinal sounds from other noises and interpreted. The merits of the intestinal phonogram are:

1. It is possible to record and compare cases.
2. Intestinal phonography mainly reflects intestinal motility.
3. Intestinal phonography is useful for screening intestinal disorders.
4. Intestinal phonography is useful for deciding whether to perform an operation, especially in the case of ileus[5].

This new method is extremely useful for both diagnosis and treatment of intestinal obstruction.

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