Epidural Block for Treatment of Intestinal Obstruction

— Clinical and Experimental Studies —

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Seventy patients with intestinal obstruction were managed with usual conservative treatments and epidural anesthesia to block splanchnic and somatic nervous systems, for nine years from 1981 to 1990. Improvement of clinical symptoms and general conditions was accomplished in 48 patients (68.6%). In these 48 patients, 41 patients (58.6%) had complete remission of intestinal obstruction, showing flatus in 8.3 hours on an average, but seven (10.0%) had incomplete remission. For these seven, after improvements of their clinical symptoms, elective radical operations were performed within three weeks. In 22 (31.4%) patients whose symptoms were not improved at all with the epidural block, emergency exploratory celiotomies were performed, 15.4 hours on an average after the initial epidural block. Indications for surgical intervention of intestinal obstruction were decided by the absent movement of gas in the bowel in a series of plain X-rays. The effectiveness of the epidural block on the motility of the obstructed intestinal loop was experimentally confirmed in monkeys.

We suggested that the epidural block, accompanied with usual conservative treatments, be recommended as the initial treatment for intestinal obstruction. (Key words: intestinal obstruction, epidural block, neostigmine)

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Intestinal obstruction is a common disorder in acute abdomens. Advances in physiologic studies[1–4], diagnostic methods and management of the disorder, including intravenous hyperalimentation[5] have made a great improvement in its prognosis. Although criteria for corrective surgery of intestinal obstruction have been presented by some surgeons, universally accepted criteria have not been established yet. The mortality of intestinal obstruction could increase if surgical intervention is delayed too long, while unnecessary surgery could increase further adhesion. Therefore the indica-

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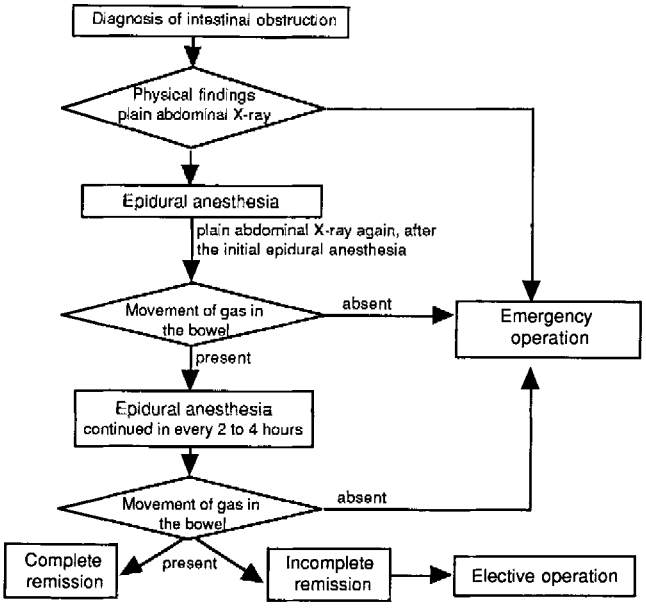

Fig. 1.

tions for surgery should be established in the early stage.

Accelerated intestinal movement is observed during surgery under epidural anesthesia as well as after celiac plexus block for the treatment of intractable abdominal pain.

We tried the epidural block and usual initial procedure for the patients with intestinal obstruction soon after diagnosis was confirmed by history, physical examination and plain abdominal X-rays with air-fluid levels.

This paper reports the clinical and experimental results of the effect of the epidural block, and evaluates a surgical indication for intestinal obstruction decided upon initial treatments with the epidural block. Experiments were performed to investigate the effect of the epidural block on the motility of the closed small intestinal loop in Japanese monkeys.

Methods

Clinical Study

Seventy patients with intestinal obstruction admitted to Hirose Hospital in Fukuoka received the epidural block as a part of initial treatments for the period of 1981 to 1990. Patients with mesentric thrombosis and hernias were excluded from this study. Seventy patients consisted of 47 males and 23 females aged from 20 to 80. Most of them had some previous abdominal surgeries.

The protocol is shown in figure 1. After the diagnosis was confirmed by a patient's history, physical examination and X-ray study, the initial procedure started. It consisted of intravenous infusion, correction of electrolyte imbalance, administration of antibiotics and insertion of a nasogastric tube. The catheter for the epidural block was placed at the 10th thoracic vertebral level to block the splanchnic nerves[6]. Five to seven ml of 1% or 2% mepivacaine hydrochloride were injected into the epidural space through the catheter, depending on the patients' conditions. Hypotension due to the epidural block was prevented and treated mainly with intravenous volume replacement.

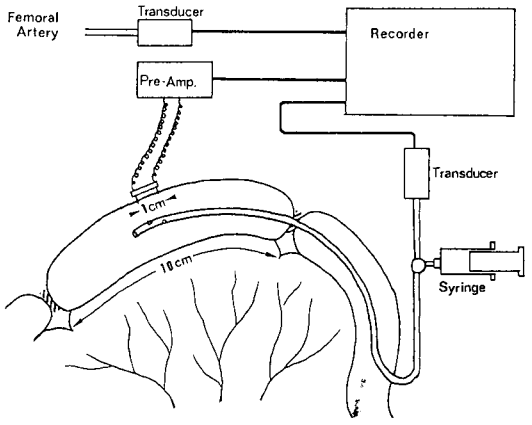

Fig. 2.

A plain abdominal X-ray was taken again 2 to 3 hours after the first epidural anesthetic agent was administered. The anesthetic effect had subsided by this time. Detailed changes in bowel gas patterns were evaluated by comparing this with the initial X-ray findings. If changes in the gas pattern were noted, conservative treatments were continued and the epidural block was applied at intervals of 2 to 4 hours thereafter. Clinical symptoms and general conditions of the patients were observed carefully during the period of these treatments, and plain abdominal X-rays were taken if necessary. When there was any evidence of clinical deterioration and/or deteriorating change in bowel gas pattern in the series of X-ray photographs, immediate surgical operation was performed.

Experimental Study

Seven Japanese monkeys (Macaca fuscata) weighing 7 to 11.5 kg were chosen for this experiment. After intramuscular ketamine hydrochloride of 5 to 7.5 $mg \cdot kg^{-1}$ was administered, the tip of catheter was placed in the epidural space at about the 10th thoracic vertebral level through the intervertebral space between T_{11}–T_{12} or T_{12}–L_1. The catheter tip was confirmed by contrast media in X-ray. Then celiotomy by midline incision was made. Preparation for monitoring electrical activity and intraluminal pressure of the obstructed small bowel was achieved 30 cm distal to the ligament of Treitz. The schematic illustration of preparations is shown in figure 2. A 10 cm loop of obstruction was made by ligating both proximal and distal portion by silk sutures. Two stainless steel electrodes (0.1 mm in each diameter) were mounted 10 mm apart on the 1.5 × 0.5 cm plastic plate as bipolar electrodes. These bipolar electrodes were inserted into the muscle layer at the middle part of the obstructed intestinal loop and fixed with the medical adhesive agent (Aronalpha®). The electrical activity was recorded (NIHON KOHDEN Medical recorder PMP-3004). The time constant of the amplifier was 0.03 seconds and only the spike activities were recorded, which showed a close relation to contractions of the intestine[7]. Intraluminal pressure to detect the mechanical activity was obtained through a cannula of 2 mm in diameter in the obstructed loop. A three-way stopcock was placed between the cannula and a pressure transducer (Statham®). The syringe containing normal saline was connected to this stopcock. The intraluminal pressure could be elevated by injecting normal saline into the obstructed intestinal loop. Electrical activity and intraluminal pressure were recorded simultaneously. The arterial pressure was also recorded from the catheter inserted into the femoral artery if necessary. Experiments were divided into two groups.

Group 1: Five monkeys were used in this group. Preparation procedures were complete as described above. As a control study, the intraluminal pressure was elevated as a model of clinical intestinal obstruction, to approximately 20 mmHg by infusion of normal

Table 1. Results of our management with conservative treatments and the epidural anesthesia in 70 cases of intestinal obstruction

Complete remission without operation		41	(58.6%)
Incomplete remission following elective radical operation		7	(10.0%)
stenosis	4		
adhesion	2		
other	1		
		48	(68.6%)
Emergency exploratory celiotomy		22	(31.4%)
strangularion	11		
obstruction or severe stenosis	5		
severe adhesion	4		
others	2		
		70	

saline, then intestinal activities became stable in 15 min. In this condition, elevated intraluminal pressure recordings were maintained for 20 min, then 2 ml of 2% mepivacaine hydrochloride was injected into the epidural space through the catheter. Subsequently the influences of the epidural block on electrical activity, intraluminal pressure and arterial pressure were observed for the following 40 min.

Group 2: Two monkeys were used in this group. Preparation procedures and recordings were performed in the same manner as in group 1. Neostigmine of 0.5 mg (i.v.) was administered instead of the epidural block.

Results

Clinical Study

Outcomes of our treatments with the epidural block for intestinal obstruction are shown in the table 1. Improvement of clinical manifestation was accomplished in 48 patients (68.6%). Out of these 48 patients, 41 patients (58.6%) had complete remission of symptoms and signs of intestinal obstruction, by passing flatus in an average of 8.3 hours, and they were subsequently discharged without operations. Seven patients (10.0%) had incomplete relief of the symptoms, although their general conditions had improved. These seven patients had further examinations for the cause of the intestinal obstruction and received elective corrective operations within 3 weeks.

Emergency exploratory celiotomy was performmed in 22 patients (31.4%). These patients are listed in detail in table 2. All except one patient underwent surgical intervention for the intestinal obstruction, because there were no changes in the gas pattern in the bowel confirmed by the series of abdominal X-rays during conservative treatments with the epidural block. One patient was operated upon because of peritoneal irritation due to a perforated appendix. The interval from the beginning of the epidural block to surgery ranged from 1 to 48 (mean 15.4) hours. In this series, there were no perforations of the obstructed loops, or deaths.

Experimental Study

Group 1: In the obstructed intesti-

Table 2. All patients who needed surgical intervention of intestinal obstruction are listed

No.	age	sex	epi.block to operation* (hour)	operative finding	performed operation	previous operation	
						age	operation
1	45	f	29	strangulation	resection of intestine	19 26 38	appendectomy ectopic pregnancy TAH
2	56	f	22	strangulation	removal of strangulation	54	colectomy
3	21	m	17	strangulation	removal of strangulation	21	laparotomy due to trauma
4	69	m	32	strangulation	resection of intestine	35	laparotomy due to ileus
5	32	f	3	atrangulation	resection of intestine	26	laparotomy due to trauma
6	52	f	24	strangulation	resection of intestine	26 50	appendectomy mole TAH
7	54	f	7	strangulation	resection of intestine	23 45	cholecystectomy TAH
8	55	m	5	strangulation	resection of intestine	14 48	appendectomy partial gastrectomy
9	54	m	28	strangulation	resection of intestine	54	partial gastrectomy
10	29	m	48	strangulation	resection of intestine	17	laparotomy due to ileus
11	36	m	7	strangulation	resection	21	appendectomy
12	52	m	16	adhesion	adhesiolysis partial colectomy	52	colectomy
13	59	m	16	adhesion	resection of intestine	52	colectomy
14	32	m	30	adhesion	resection of intestine	32	laparotomy due to trauma
15	39	m	3	adhesion	adhesiolysis	35	partial gastrectomy
16	55	m	1	stenosis (Crohn's)	resection of intestine	55	partial gastrectomy
17	49	m	4	stenosis tuberculosis	resection of intestine	48	laparotomy due to ileus
18	45	m	5	stenosis (Crohn's)	ileocecal resection	28	apendectomy
19	55	f	4.5	stenosis colon cancer	colectomy	25	appendectomy
20	20	m	6	peritonitis	appendectomy		none
21	53	m	2	volvulus of sigmoid colon	sigmoidectomy	34	appendectomy
22	30	m	2	obstruction (food)	resection of intestine	20	partial gastrectomy

The average time from epidural block to operation* is 15.4 hours

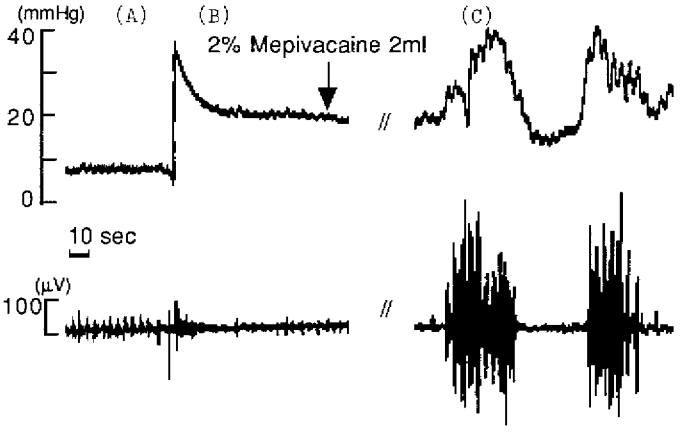

Fig. 3.

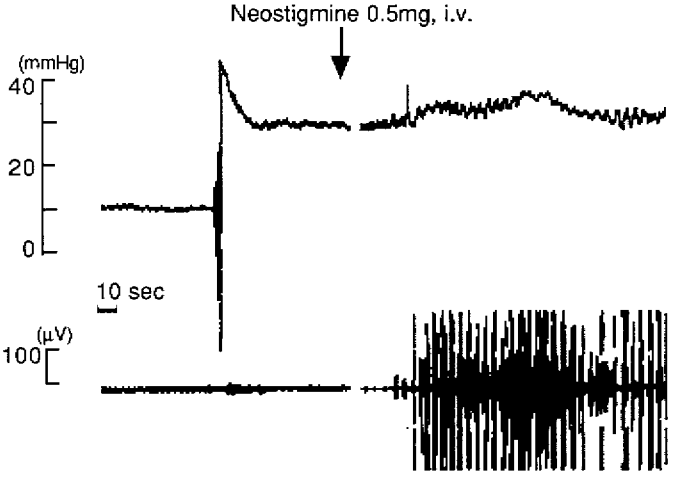

Fig. 4.

nal loop initial recordings (fig. 3A), just after preparation procedures were accomplished, electrical activities of 1 to 3 spikes or spike bursts of 20 to 160 mV in amplitude were observed every 4 to 7 seconds. Intraluminal pressure lose slightly (1 to 3 mmHg) in response to electrical activities. After the elevation of the intraluminal pressure by 20 mmHg (fig. 3B), small spikes of 10 to 20 mV were observed irregularly but the intraluminal pressure did not change. After the injection of 2 ml of 2% mepivacaine hydrochloride into the epidural space, all electrical activity, the intraluminal pressure and the arterial pressure changed as follows. The arterial pressure began to fall immediately after the epidural block. Spike bursts composed of 4 to 5 spikes with low amplitude started within one minute but these electrical activities did not alter the intraluminal pressure 30 seconds after the injection of mepivacaine. The amplitude and the number of spikes in burst activities increased gradually. Five minutes after the epidural block, burst activities with a train of 6 to 7 spikes were regularly generated in a group in maximal 200 mV and intraluminal pressure elevated by 2 to 3 mmHg, simultaneously. These changes continued for 15 to 20 min. At the time when the maximum

amplitude of the spikes was 400 mV, simultaneous elevation in the intraluminal pressure up to 15 mmHg was also observed (fig. 3C).

Group 2: A dose of 0.5 mg neostigmine (i.v.) generated a series of enormous spike bursts with 10 to 15 spikes of 1000 mV in amplitude and continuous elevation of the intraluminal pressure of 10 to 15 mmHg (fig. 4). These alterations induced by neostigmine were quite different from those observed after the epidural block (fig. 3C).

Discussion

For postoperative intestinal obstruction, there have been many reports of investigation regarding pathophysiology[4], and histochemical and electrophysiological changes[8]. They are related to the treatments including administration of anti-adrenergic and/or cholinergic agents[9–10]. Spinal[11] or epidural anesthesia[12] have also been tried for the treatment of the early postoperative intestinal obstruction because the splanchnic nerve is one of the important factors involved in intestinal obstruction. There are no reports on the conservative treatment using the epidural block for the patients with intestinal obstruction.

Bizer et al.[13] reported retrospective results of 405 patients with mechanical obstruction. They showed that the most frequent cause of obstructions was adhesion (74%), the incidence of bowel strangulation was 10.1%, and 46% of the patients who received more than 24 hours of non-operative therapy had relief of obstruction. They also showed no statistical significance between the managements with long intestinal tube and with a simple nasogastric tube. There was a close correlation between strangulated bowel and clinical findings such as feculent vomiting, hypoactive or absent bowel sounds and white blood cell counts higher than 18,000/cm^3. They suggested that a trial with initial non-operative management was an acceptable and successful mode of therapy in obstructions due to adhesion and inflammatory disease, and that it should be recommended only for the first 48 to 72 hours. Hoffstetter[14] concluded that patients with a prior abdominal surgical procedure, absence of any signs of strangulation and partial small bowel obstruction on X-rays, could be treated initially by long tube decompression and careful observation, and that lack of definite improvement in 24 hours demanded laparotomy.

The results of 70 patients in this study managed by conservative treatments with the epidural block and nasogastric decompression showed improvement of clinical symptoms in 48 patients (68.4%). Forty-one of 48 patients (58.6%) passed flatus in an average of 8.3 hours while seven (10.0%) showed incomplete improvement and received further examinations for the cause of intestinal obstruction followed by elective corrective operations in three weeks. In this study, 22 patients (31.4%) did not show any evidence of the movement of gas in the series of plain abdominal X-rays and they received surgical intervention in an early clinical stage in the period of in 15.4 hours on an average from the first epidural block to the surgeries.

We believe that the epidural block as an initial treatment for intestinal obstruction is a useful procedure in order to differentiate whether immediate surgical interventions are needed or not. When patients' symptoms and signs improve completely or partially with this procedure, patients are observed carefully without immediate surgery. If no improvement is obtained in patients' conditions and/or gas pattern in the plain abdominal X-ray after the epidural block, immediate surgery

should be performed.

It has been suggested that the epidural block may be contraindicated for the patients with intestinal obstruction because it can cause a rupture of the dilated bowel, but we consider that this danger could be prevented by close observations of clinical manifestations and the movement of gas in the series of plain abdominal X-rays.

There are many reports investigating intestinal motility during intestinal obstruction. Neely and Catchpole[15] collected previous reports concerning the pathophysiology of intestinal obstruction, and consequently described that the inhibition of intestinal motility is elicited mainly by sympathetic activation i.e. a reflex inhibition. Therefore they showed that a sympathetic block is the most rational treatment for intestinal obstruction. They also showed the importance of parasympathetic drive and practical usefulness of combined use of sympatholytics and parasympathomimetics in their patients. Spinal anesthesia and splanchnic nerve block as sympatholytic methods were also discussed in their report. They stated that spinal anesthesia showed just a temporary favorable effect with hypotensive episode[1] and that splanchnic nerves include not only adrenergic but cholinergic fibers. In conclusion, they recommended a pharmacological treatment at the receptor sites.

In the monkey's intestine, small spikes originated immediately after abdominal preparation but the intraluminal pressure indicating contraction of the bowel remained almost unchanged. Furthermore, these spikes disappeared when intraluminal pressure was elevated to the level of 20 mmHg. These results suggested that the inhibition of intestinal motility occurred by operating manipulation[16], and that the so called inhibitory reflex phenomenon, mediated through the sympathetic nervous system[17], took place initiated by distension of the intestinal wall. The epidural block seems to reverse this reflex inhibition by splanchnic nerve block.

Frequent spike bursts with large amplitude were induced by intravenous administration of neostigmine. These spike bursts were different from those induced by the epidural block, which appeared regularly with simultaneous rises and falls in intraluminal pressure. These results suggest that administration of neostigmine caused spastic contractions.

Aitkenhead et al.[18] showed in their retrospective study that dehiscence occurred in 7.4% of large bowel anastomosis in the subarachnoid or extradural spinal nerve block group compared with 23.1% in the control group.

Pain might disappear due to blocking of visceral afferent pathways. The tension of abdominal wall might also diminish because of inhibition of motor fibers under the epidural block. A vicious cycle, the so called pain-defence mechanism, can be interrupted.

The epidural catheter inserted for conservative treatments were used for the clinical anesthesia for surgery. The postoperative course would be smooth because postoperative pain could be relieved by the epidural block. Further, intestinal motility were accelerated, and this prevents postoperative ileus due to the epidural block.

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