The Effects of Dopamine Infusion during Operation on the Postoperative Liver Dysfunction

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Dopamine improves renal function and renal blood flow by increasing cardiac output but its effect to ameriolate postoperative liver dysfunction has not yet been defined. Effect of 3–5 $\mu g \cdot kg^{-1} \cdot min^{-1}$ dopamine was studied in 22 patients who had total gastrectomy (dopamine group), and was compared with 22 patients who underwent the same operation and without dopamine infusion (control group).

Liver function was evaluated from serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT) values. Although postoperative SGOT and SGPT values in both groups were increased significantly higher than the preoperative values, the increases in SGOT (40 ± 14 IU) and SGPT (32 ± 15 IU) values in the dopamine group were significantly less than those in the control group (67 ± 27 IU, 43 ± 19 IU) ($P < 0.05$, $P < 0.01$).

In conclusion, these results suggested that this observation might be explained by amelioration of the postoperative liver dysfunction by infusion of dopamine. Dopamine infusion at a small dose during upper abdominal surgery is benefitial for liver function. (Key words: dopamine, SGOT, SGPT, postoperative liver dysfunction)

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The alteration in liver function occurring after operation may be related to changes in splanchnic blood flow and oxygen consumption[1] and significant reduction in hepatic blood flow occurring during operation, which are related to the nature of the operation, its site and the degree of surgical trauma[2]. These previous reports suggest that prevention of reduction in hepatic blood flow or maintenance of blood flow during operation will be able to ameliorate the liver dysfunction postoperatively. Dopamine increases the hepatic circulation by increasing cardiac output in man[3].

We investigated the ameliorative effect of dopamine infusion at a rate having little influence on blood pressure during operation on postoperative liver dysfunction in patients undergoing total gastorectomy.

Methods

Fourty-four non-obese adult patients who underwent elective total gastrectomy were studied at random, and all gave their informed consent. The protocol was approved by the Kurashiki Central Hospital Human Research Committee. The patients were between 47 and 78 years old. No patients had a history of hepatic disease, had taken

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Table 1. Patient's data

	Control group	Dopamine group
No of patients	22	22
Age (years)	65 ± 10	63 ± 13
Sex		
female	8	8
male	14	14
Weight (kg)	50 ± 15	52 ± 10
Duration of operation (min)	182 ± 51	199 ± 89
Urine volume (ml)	306 ± 163	490 ± 365
Blood loss (gr)	353 ± 193	388 ± 177
Hypotension period (min)[1)]	5 ± 10	5 ± 10
Hypertension period (min)[2)]	15 ± 15	15 ± 10
Diuretics (cases)	11	6*
Complications	none	none
Outcome	alive	alive

(mean ± SD)

*Significantly different from control group ($P < 0.01$)

1) Hypotension means 80 mmHg of systolic blood pressure.

2) Hypertension means 160 to 180 mmHg of systolic blood pressure.

drugs known to alter liver function, or had previously received a halogenated anesthetic. Preanesthetic medication was with hydroxyzine 50 mg i.m. and atropine 0.5 mg i.m. 60 min prior to operation. Before induction of anesthesia epidural catheter was inserted at either the T9–10 or L2–3 intervertebral space. Anesthesia was induced with pancuronium 1 mg i.v. followed by thiamylal 4 $mg{\cdot}kg^{-1}$i.v. and pancuronium 6 mg i.v. to faciliate tracheal intubation.

Anesthesia was maintained with 33 per cent oxygen in nitrous oxide and 1.0–1.5 per cent enflurane. Pancuronium was administered to all patients to provide intraoperative muscle relaxation. After induction and before closure of incision buprenorphine 0.1 mg diluted in 10 ml of an isotonic saline was injected via epidural catheter, as an anesthetic adjuvant and postoperative analgesia. Intravenous fluid administration consisted of 5–8 $ml{\cdot}kg^{-1}{\cdot}hr^{-1}$ lactated Ringer's solution. Patients who were given blood transfusion during operation were deleted from this study.

Patients receiving continuous infusion of dopamine at a rate of 3–5 $\mu g{\cdot}kg^{-1}{\cdot}min^{-1}$ were compared with patients not receiving dopamine. Patients were allocated randomly in two groups; control group and dopamine group. The control group consisted of 22 patients. The dopamine group consisted of 22 patients who were administered dopamine intravenously at the rate of 3 to 5 $\mu g{\cdot}kg^{-1}{\cdot}min^{-1}$ throughout the operation. At the end of surgery, neuromuscular blockade was reversed with neostigmine 2.0 mg and atropine 1.0 mg.

Samples of venous blood for liver function (total bilirubin (t. bilir), serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), and lactate dehydrogenase (LDH) and renal function (BUN and serum creatinine) determinants were obtained on the day before operation and within 3 hrs after the operation. Results were analyzed by analysis of variance, and $P < 0.05$ was considered significant.

Results

Patient's age, weight, sex distribution, duration of operation and fluid balance are summarized in table 1. There were no significant differences in surgical trauma between the control group and dopamine group.

Table 2. Effects of dopamine on hepatic functions

	Control group (n=22)		Dopamine group (n=22)	
	before	after	before	after
Total bilirubin ($mg{\cdot}dl^{-1}$)	0.5 ± 0.3	0.8 ± 0.4*	0.5 ± 0.3	0.7 ± 0.4*
SGOT (IU)	24 ± 13	67 ± 27*	21 ± 8	40 ± 14*°
SGPT (IU)	17 ± 12	43 ± 19*	19 ± 9	32 ± 15*°
LDH (IU)	383 ± 251	666 ± 666*	339 ± 77	521 ± 227*
BUN ($mg{\cdot}dl^{-1}$)	16 ± 5	17 ± 6	15 ± 6	17 ± 13
Creatinine (md)	1.0 ± 0.4	1.1 ± 0.4	0.9 ± 0.2	1.0 ± 0.3

(mean ± SD)

*Significantly different from values before operation ($P < 0.01$).
°Significantly different from values of control group ($P < 0.01$).

In both groups, t. bilir, SGOT, SGPT, and LDH in the postoperative period were higher than those obtained preoperatively ($P < 0.01$). The increases in SGOT and SGPT values after surgery were significantly less in the dopamine group than those in control group ($P < 0.01$, $P < 0.05$). Although there were no significant chanages in BUN and creatinine in any group or period, there was a significant difference in numbers of cases given diuretics (5 to 10 mg of furosemide) between the control group and dopamine group. None of patients had any postoperative complications.

Discussion

Dopamine infusion at a rate of 3–5 $\mu g{\cdot}kg^{-1}{\cdot}min^{-1}$ during surgery seemed to inhibit an postoperative increase in both SGOT and SGPT in patients undergoing total gastrectomy. This dose range of dopamine can be considered as a rate for maintaining adequate blood pressure during surgery. Viegas and Stoeling[4] observed that LDH_5 did not change following lower abdominal surgery (hysterectomy), were higher than the preoperative values after upper abdominal surgery (cholecystectomy) and concluded that the site of operation was related to the postoperative liver dysfunction. Gelman[2] found a reduction in hepatic blood flow caused by surgical trauma itself, and this reduction was much greater in upper abdominal surgery (from 42 to 48% of its initial values) than in peripheral surgery (from 82 to 76% of its initial values) under general anesthesia. The difference in reduction in hepatic blood flow would be related to the magnitude of the surgical trauma. In the present study patients with total gastrectomy were studied because of proximity of the surgical field to the liver and magnitude of surgical trauma. Moreover, the absence of detectable differences between commonly used anesthetic drugs with respect to postoperative liver dysfunction[4] and less reduction in hepatic blood flow by anesthetics[2] were emphasized. Therefore, we suspected that postoperative liver dysfunction is strongly related to the reduction in hepatic blood flow during surgery. Furthermore, if such reduction in hepatic blood flow is prevented or blood flow is maintained during surgery, the postoperative liver dysfunction could be ameliorated. Our data suggested that dopamine inhibit an increase in SGOT and SGPT caused by surgical trauma.

Dopamine increased hepatic blood flow by 82% at a rate of 6 $\mu g{\cdot}kg^{-1}{\cdot}min^{-1}$ [5] and 64% at rate of 10–12 $\mu g{\cdot}kg^{-1}{\cdot}min^{-1}$ of intravenous infusion[3], and improved the hepatic circulation by augmentation of cardiac output. Dopamine infusion (4 $\mu g{\cdot}kg^{-1}{\cdot}min^{-1}$) also improved the reduction of superior mesenteric artery blood flow during thoracic epidural anesthesia[6]. Dopamine was the most effective in maintenance of hepatic blood flow during surgery and prevention of postoperative liver dysfunction. Amelioration of liver function by dopamine suggested that the reduction in hepatic blood flow plays a role in postoperative liver dysfunction. Other factors may contribute to postoperative liver dysfunction, such as pre-existing hepatic disease, hypotension, nutritional status, blood transfusion, duration of operation, anesthetics and site of operation, were either absent or similarly present in two groups. There was no significant difference in BUN level, creatinine level, and urine volume between the two groups, but diuretics were used significantly less in the dopamine group than in the control group. This is due to diuretic properties of dopamine[7].

The measurement of serum transaminases (SGOT, SGPT) is indicative of hepatocellular destruction, although SGOT is also elevated in severe cardiac or skeletal muscle destruction[8]. In conclusion, dopamine infusion at a rate of 3–5 $\mu g \cdot kg^{-1} \cdot min^{-1}$ during surgery, can ameliorate the postoperative liver dysfunction by increasing hepatic blood flow.

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