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# Effects of somatostatin on splanchnic hemodynamics in cirrhotic patients with portal hypertension

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**Subject headings** hypertension, portal; liver cirrhosis; somatostatin; hemodynamics

## INTRODUCTION

Esophageal variceal bleeding (EVB) is one of the most common complications of cirrhosis with portal hypertension. In recent years, great progress has been made in medicinal treatment. Somatostatin has been widely used in clinics, for it can effectively lower the portal venous pressure (PVP) with little side effect. The aim of this study is to assess the effect of somatostatin on portal venous pressue and splanchnic hemodynamics in patients with liver cirrhosis and portal hypertension.

## MATERIALS AND METHODS

### *Subjects*

The study subjects were 20 cirrhotic patients with portal hypertension, including 12 men and 8 women. Their mean age was 46.6±13.4 years. All patients had a history of hepatitis B with positive HbsAg and were pathologically diagnosed as having liver cirrhosis.

### *Methods*

All patients were asked to fast and lie supine for 12 hours before somatostatin infusion. The inner diameter and blood velocity of the portal, left hepatic, middle hepatic and right hepatic veins were measured. Using ACUSON 128 × P/10 color Doppler ultrasonography. A continuous infusion of somatostatin was then administered via the peripheral vein at a rate of 250 μg/h. The measurement was repeated after an hour. The blood flow was calculated according to the formula $Q= 60 \pi r^2 V$. The $\pi r^2$ in the formula is the sectional area ($cm^2$) of the vein, V represents the mean value of maximum blood velocity (cm/sec) and Q is blood flow (mL/min). Seven days after the operation, portal venous pressure, blood pressure (BP) and heart rate (HR) were measured in 15 of the 20 patients who had undergone right gastroepiploic venous catheterization. The measurement was taken before infusion of somatostatin and after 1 and 1.5 hours. Students'*t* test was used to compare the data collected before and after the treatment.

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## RESULTS

Portal venous pressure was measured via the catheter in the right gastroepiploic vein of the 15 portal hypertensive patients at 0, 1.0, and 1.5 hour after somatostatin administration. The portal venous pressure decreased from 20.8±2.0mmHg ( 0h ) to 18.2mmHg±2.0mmHg (1h) and 18.0mmHg±2.0 mmHg (1.5h), respectively, the differences being statistically significant ($P$<0.01). However, the difference between 1h and 1.5h was insignificant ($P$>0.05). The infusion of somatostatin did not affect the systolic arterial pressure (SAP), diastolic pressure (DAP) and HR (Table 1).

**Table 1 Effect of somatostatin on PVP, BP and HR**

| | *n* | 0 h | 1 h | 1.5 h |
|---|---|---|---|---|
| PVP (mmHg) | 15 | 20.8±2.0 | 18.2±2.0[b] | 18.0±2.0[b] |
| SAP (mmHg) | 15 | 130.0±14.0 | 134.1±12.0 | 132.0±16.0 |
| DAP (mmHg) | 15 | 82.0±9.2 | 84.0±14.0 | 83.1±14.0 |
| HR (beat/sec) | 15 | 81.2±7.3 | 79.1±6.2 | 80.7±6.9 |

[b]$P$<0.01 as compared to 0 h.

The hepatopetal flow was measured by color Doppler ultrasonography in all the 20 patients. The sectional area of portal vein decreased by 7.28% after the infusion of somatostatin but the difference being insignificant ($P$>0.05). The average value of portal vein maximum blood velocity decreased by 18.96% from 19.72±7.75 cm/sec to 15.98±7.26 cm/sec, and the average total portal vein blood flow was decreased by 19.72% from 1643.21 mL/min± 757.25 mL/min to 1319.49 mL/min±622.39 mL/min after the infusion, the difference being very significant ($P$<0.01).

In 19 of the 20 patients, the total sectional area and the total blood flow of the three hepatic veins were calculated after somatostatin infusion. The

former increased from 0.72 $cm^2 \pm 0.21$ $cm^2$ to 0.76$cm^2$±0.24$cm^2$, and the latter increased from 1786.22 mL/min ± 923.37 mL/m in to 1836.17mL/min±844.24mL/min. The changes were not significant ($P$>0.05).

## DISCUSSION

It has been shown that humoral substances play important roles in the pathogenesis of portal hypertension. Due to liver function damage and the shunt of collateral circulation, changes occurred in the blood levels of these vasoactive humoral substances and some of them can regulate the portal venous pressure by interfering with blood vessel resistance or blood flow of the portal vein[1]. The medicinal therapy is somewhat based on this hypothesis.

Somatostatin, one of the peptide hormones originating from neural-ectoderm, is able to inhibit the release of some hormones *in vivo* and lower the portal venous pressure by changing splanchnic blood flow. Treatment of variceal hemorrhage with somatostatin in portal hypertension has been successful according to many recent reports[2,3]. Seven days after the 8 mm H-graft portacaval shunts (HGPCS), we measured the portal venous pressure via the catheter in the right gastroepiploic vein before and after the infusion of somatostatin and found that somatostatin could lower the portal venous pressure by 2.6 mmHg-2.7 mmHg. There was no significant difference in the portal venous pressure 1 or 1.5 hours after the administration. The results indicated that continuous infusion of somatostatin could decrease the portal venous pressure. At the same time, there was no significant changes in BP or HR. We concluded that somatostatin had fewer side effects than other drugs used to lower the portal venous pressure and had little influence on systemic hemodynamics. It appears that somatostatin can be used clinically to treat bleeding from esophageal varices of portal hypertension.

In order to find out the mechanism of how somatostatin lowers the portal venous pressure, we measured the sectional area and maximum blood velocity, and flow through the portal, left hepatic, middle hepatic and right hepatic veins using color Doppler ultrasonography before and after somatostatin administration. The color Doppler flowmetry in the study of portal hypertensive hemodynamics proved to be an accurate, simple, non-invasive and easily repeated method[4]. Michel[5] reported that there existed consistent results by both the pulsed Doppler and electromagnetic flowmetry methods in measuring the portal vein blood flow ($r$ = 0.918). Under these fixed conditions, the data has shed light on the changes in the portal venous blood flow in a same patient observed by a same examiner[4-6]. Our study indicates that the inner diameter changed slig htly and that the sectional area of the portal vein decreased by 7.28% with no significant difference after the infusion, suggesting that somatostatin itself can not directly constrict the portal vein. Our study also indicates that the maximum blood velocity and the maximum portal vein blood flow decreased significantly by 18.96% and 19.72% respectively after the use of somatostatin. This suggests that somatostatin can lower portal venous pressure by reducing blood velocity and blood flow, which was commonly found in other reports[7]. However, how somatostatin reduces portal vein blood flow remains unclear. Glucagon is reported to be able to increase blood flow and portal venous pressure[8]while inhibiting the effect of somatostatin in reducing portal vein blood flow[9]. This suggests that somatostatin inhibits the release of glucagon. Somatostatin was also reported to be able to inhibit the renin-angiotensin-aldosterone system and lessen $Na^+$ retention[10,11]. We also discovered that the summation of the three hepatic venous sectional areas and blood flow through these areas increased slightly without any significant differences. In conclusion, the role of somatostatin in slanchnic hemodynamics in cirrhotic patients with portal hypertension should be further investigated.

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