IMPACT OF A TRANSPARENT HOOD ON THE PERFORMANCE AND THERAPEUTIC RESULT OF ENDOSCOPIC INJECTION SCLEROTHERAPY

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Abstract : **Objective:** Although the effectiveness of a transparent hood has been reported in various endoscopic procedures, there are only a few reports regarding the benefit of a transparent hood in endoscopic injection sclerotherapy (EIS). In the current study, we conducted a retrospective evaluation of the efficacy and long-term benefit of an oblique transparent hood on EIS. **Methods:** The transparent hood, manufactured by Olympus (MAJ295 or MAJ296), consisted of a reusable wide oblique distal attachment with rim. This hood was attached when the varix was fine (F0 or F1). In this retrospective study, a total of 201 patients were recruited, and 99 patients (designated as the "Hood Group") received this hood while 102 patients (designated as the "Conventional Group") did not. We compared the rate of intravariceal injection, enhanced supply vessels, variceal eradication, and recurrence between these two groups. **Results:** This transparent hood provided a better visual field, and there was no serious complication in any of the patients. Intravariceal injection rates in the Hood Group and Conventional Group were 73.9% (190/257) and 57.7% (146/253) respectively ($p < 0.01$). The rates of enhanced supply vessels in the Hood Group and Conventional Group were 89.8% (89/99) and 72.5% (74/102) respectively ($p < 0.01$). The rates of variceal eradication did not differ significantly. We also assessed the cumulative non-recurrence probability for up to 3000 days between the two groups. The Hood Group was statistically superior to the Conventional Group ($p < 0.01$) **Conclusion:** The application of an oblique transparent hood method is safe and effective for intravariceal EIS. This hood contributes especially to reduction of the long-term recurrence probability.

Key words : Oblique transparent hood, Endoscopic injection sclerotherapy (EIS), Intravariceal injection, Variceal recurrence

Introduction

Endoscopic injection sclerotherapy (EIS) is an established procedure for esophageal varices[1]. However, one of the disadvantages is that considerable experience is necessary to become proficient in intravariceal EIS. Accurately puncturing a fine varix (F0 or F1) is sometimes difficult even for skilled endoscopists. In recent years, the main axis of esophageal varix treatment has shifted from intravariceal EIS to endoscopic variceal ligation (EVL) because of its simplicity[2]. On the other hand, in terms of curative and recurrence rates, intravariceal EIS is superior to EVL[3]. There should be certain levels of advantages if intravariceal EIS itself could be performed more conveniently. Therefore, in 2004 we started modifying the attachment of a transparent hood for fine varices whose form was either F0 or F1 in pursuit of accurate intravariceal EIS. The attachment of a transparent hood to the endoscopic tip enables the endoscopist to perform delicate procedures more easily[4]. So transparent hoods are widely used for a variety of endoscopic procedures. There are numerous reports on the efficacy of transparent hoods such as endoscopic hemostasis for non-variceal hemorrhage[5], and total colonoscopy[6)-7]. But, there are only a few reports on the efficacy of transparent hood for performing EIS.

In the present study, we retrospectively evaluated the efficacy of intravariceal EIS with a transparent hood by analyzing the intravariceal injection rate, supply vessel varicealography, and cumulative non-recurrence rate.

Patients and Methods

Patients

A total of 201 patients with esophageal varices who had received EIS at Nara Medical University Hospital from 1994 to 2007 were recruited in this study. A transparent hood was used in 99 patients (cases from 2004 to 2007), but not in the remaining 102 patients (cases from 1994 to 2004). As previously described, because we started using the transparent hood method in 2004, most cases before 2004 were without a transparent hood. We defined the group that consisted of the former 99 patients as the “Hood Group”, and the latter 102 patients as the “Conventional Group”. The hepatic reserve was classified according to Child-Pugh grading (Child A, B and C). Esophageal varices were classified according to the Esophagogastric Varices Grading System proposed by the Japan Society for Portal Hypertension[8]. The criteria included color (white [Cw] or blue [Cb]), form (straight and small [F1], nodular [F2], large or coiled [F3], and the presence of the red color sign on varices [RC]) and the presence of intramucosal venous dilatation. We defined the indication for primary prophylaxis as F2/F3 varices with a positive RC sign. In principle, Child C cases were not included for the indication of primary prophylaxis.

Methods

Following premedication with intramuscular injections (atropine sulfate, pentazocine, and hydroxyzine) and intravenous injections (scopolamine butylbromide or glucagon, and diazepam), a one-channel endoscope was inserted[2]. All EIS sessions were performed by expert endoscopists in our department by using gastrointestinal endoscopes manufactured by Olympus Medical Systems Corp. (GIF-Q200, GIF-XQ200, GIF-Q240, GIF-XQ240, and GIF-Q240Z). For intravariceal EIS, the sclerosant 5% ethanolamine oleate diluted with iopamidol (5% EOI) was injected into varices by using a TOP Endoscopic Puncture Needle for Esophagus 25 Gauge. All intravariceal EIS were performed under fluoroscopic guidance in order to confirm whether the 5% EOI was accurately injected into the varix, and to evaluate the blood supply vessels to esophageal varices during the procedure. When 5% EOI was extravasated, the injection was stopped immediately. Unless there were any serious adverse effects, the EIS session was repeated weekly until the esophageal varices disappeared. In the last session of EIS, the entire esophageal mucosa from 5 cm proximal to the esophagogastric junction was thermocoagulated circumferentially with MBPEC[9)-10)] or APC[11)]. As the endoscopic sessions were repeated, the forms of the varices got smaller. In the Hood Group, the transparent hood was attached when the forms of the varices were determined to be smaller than F1 to aim for the exact intravariceal injection.

The transparent hood is a reusable wide oblique distal attachment with rim manufactured by Olympus (MAJ295 or MAJ296) (Tokyo, Japan). This hood was originally developed for endoscopic mucosal resection with cap (EMRC). Its outer diameter is 16 mm, the longest part 14 mm, and the shortest part 8 mm. It has a notch at the shortest part. This notch is fitted in the direction of the instrumental channel opening when the transparent hood is attached. (Fig. 1)

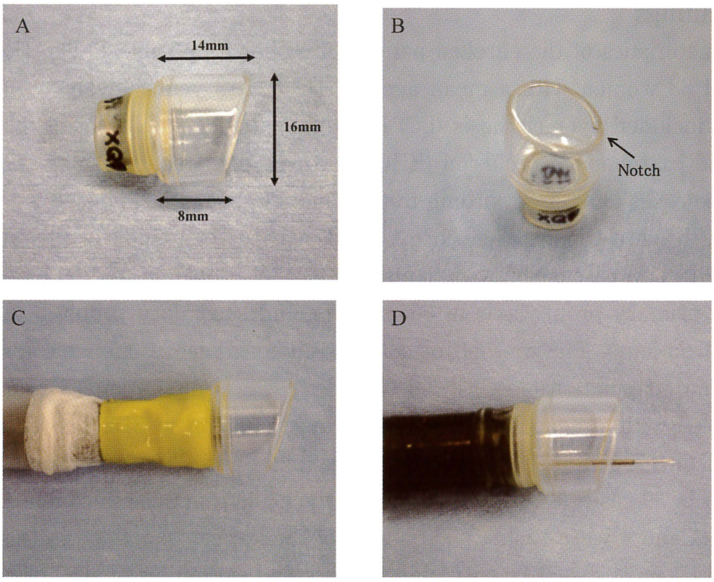

Fig. 1. Photographs of a transparent hood. A: Wide oblique distal attachment. Diameter: 16 mm, the longest part: 14 mm, the shortest part: 8 mm. B: There is a notch in the direction of the instrumental channel opening. The arrow indicates the notch. C: The hood is attached to the tip of the endoscope and fixed with vinyl tape. D: Figure of an endoscope with a hood from which the needle is released.

Judgement

As research subjects, we chose cases whose varices became smaller than F1 as a result of the preceeding EIS. The total number of EIS exams was 257 in the Hood Group, and 253 in the Conventional group. Of all 510 exams, we investigated the rate of successful intravariceal injection, and we checked the varicealography to identify the supply vessels. We defined "successful intravariceal injection" as the presence of enhanced varices or supply vessels on varicealography.

We determined the effectiveness of therapies at approximately one to three months after the last EIS by esophagogastroduodenoscopy (EGD). We defined "Complete Response (CR)" as the disappearance of varices and the RC sign, "Partial Response (PR) as the disappearance of the RC sign but retention of form, and "Non Response (NR)" as retention of the RC sign. Follow-up EGD was performed every 6 to 12 months to check whether or not varices recurred. We defined "recurrence" as emergence of the RC sign.

Statistical Analysis

The Mann-Whitney U-test and the Fisher exact test were used to compare the groups for qualitative variables. The cumulative non-recurrence probability was calculated using the Kaplan-Meier method and compared by the log-rank test. A P-value of less than 0.05 was considered significant.

Results

General findings

The characteristics of the enrolled patients are shown in Table 1. The Hood Group included 66 men and 33 women with a mean age of 64.6 ± 10.8 years (mean ± SD). The etiology of the varices included liver cirrhosis (LC) in 93 patients, idiopathic portal thrombosis (IPH) in 3 patients, and extrahepatic occlusion (EHO) in 3 patients. Hepatocellular carcinoma (HCC) was present in 30 cases (30.3%). According to the Child-Pugh classification, 48 were Child-A, 45 were Child-B, and 6 were Child-C. The forms of the varices examined in this study were F0 in 4 cases, and F1 in 95 cases. Thirty patients had alcohol problems, and 69 cases did not. The aim of EIS was primary prophylaxis in 66 patients, and secondary prophylaxis (i.e., hemorrhagic cases) in 33 patients. The method of coagulation to induce esophageal mucosal fibrosis was argon plasma coagulation (APC) in all 99 cases. The Conventional Group included 66 men and 36 women with a mean age of 60.3 ± 10.5 years (mean ± SD). The etiology of the varices included LC in 99 patients, IPH in 2 patients, and Budd-Chiari syndrome in 1 patient. HCC was present in 39 cases (38.2%). According to the Child-Pugh classification, 42 were Child-A, 56 were Child-B, and 4 were Child-C. The forms of the varices examined in this study were F0 in 4 cases, and F1 in 98 cases. Twenty nine patients had symptoms of alcoholism, and 73 cases did not. The aim of EIS was primary prophylaxis in 73 patients, and secondary prophylaxis in 29 patients. The method of coagulation was multi-terminal bipolar electrocoagulation (M-BPEC) in 87 cases and APC in 15 cases. There were no significant differences in patient characteristics between the two groups except the method of coagulation.

Table 1. Characteristics of Patients

		Hood (n=99)	Conventional (n=102)	
Sex(Male・Female)		M 66 F 33	M 66 F 36	N.S
Age (mean±SD)		64.6±10.8	60.3±10.5	N.S
Etiology	Cirrhosis	93 (94.0%)	99 (97.0%)	N.S
	IPH	3 (3.0%)	2 (2.0%)	
	EHO	3 (3.0%)	0 (0%)	
	Budd-Chiari	0 (0%)	1(1.0%)	
Presence of HCC		30 (30.3%)	39 (38.2%)	N.S
Child-Pugh score	A	48 (48.5%)	42 (41.2%)	N.S
	B	45 (45.4%)	56 (54.9%)	
	C	6 (6.1%)	4 (3.9%)	
Alcoholism		30 (30.3%)	29 (28.4%)	N.S
Aim of EIS	Primary prophylaxis	66 (66.7%)	73 (71.6%)	N.S
	Secondary prophylaxis	33 (33.3%)	29 (28.4%)	
Form of varix	F0	4 (4.0%)	4 (3.9%)	N.S
	F1	95 (96.0%)	98 (96.1%)	
Coagulation method of esophageal mucosa	APC	99 (100%)	15 (14.7%)	P<0.01
	M-BPEC	0 (0%)	87 (85.3%)	

Effects of a transparent hood

The transparent hood provided a better visual field. Typical images of varices are shown in Fig. 2. Notably, there was no serious complication in this study. Intravariceal injection rates in the Hood Group and Conventional Group were 73.9% (190/257) and 57.7% (146/253) respectively, with a statistically significant difference (p < 0.01) (Table 2). Also, the rates of enhanced supply vessels in the Hood Group and Conventional Group were 89.8% (89/99) and

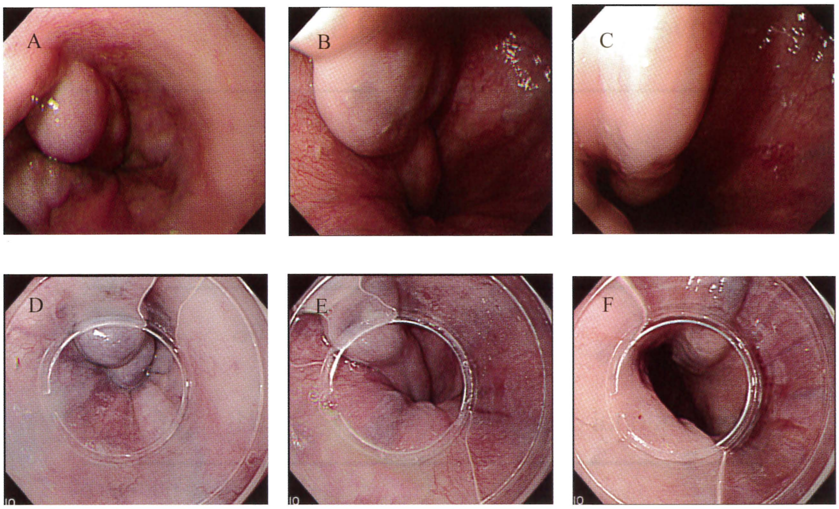

Fig. 2. Representative images of varices with or without a hood. A to C and D to F show the varices with and without a hood. A and D, B and E, C and F are the same varices with and without a hood, respectively. An oblique transparent hood provides a wider and clearer visual field.

Table 2. Rate of Intravariceal Injection

Hood	190/257 (73.9%)	P<0.01
Conventional	146/253 (57.7%)	

Table 3. Rate of Enhanced Supply Vessels

Hood	89/99 (89.8%)	P<0.01
Conventional	74/102 (72.5%)	

Table 4. Rate of Complete Response

Hood	72/95 (75.5%)	N.S
Conventional	74/93 (79.6%)	

Table 5. Details of Supply Vessels

	LGV	PGV	SGV	CP	PB
Hood	55	15	21	66	18
Conventional	54	16	11	31	6

(total number)

LGV : Left Gastric Vein
PGV : Posterior Gastric Vein
SGV : Short Gastric Vein
CP : Cardial Plexus
PB : Parietal Branch

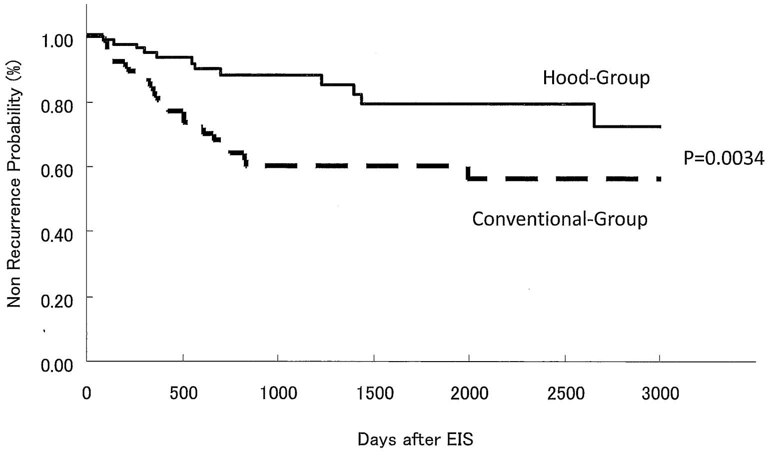

Fig. 3. Cumulative non-recurrence probability of both groups. Kaplan-Meier analysis of non-recurrent interval curves for 3000 days after EIS. The cumulative non-recurrence probability of the Hood Group was significantly higher than that of the Conventional Group (p = 0.0034). The solid line indicates the Hood Group, and the dashed line indicates the Conventional Group.

72.5% (74/102) respectively, with a statistically significant difference ($p < 0.01$) as shown in Table 3. We were able to judge the effectiveness of EIS with 95 cases in the Hood Group and 93 cases in the Conventional Group. The rates of CR in the Hood Group and Conventional-Group were 75.5% (72/95) and 79.6% (74/93) (Table 4). There was no statistical significance between the two groups. We also elucidated the respective supply vessels of the varices. Details of total numbers of supply vessels are listed in Table 5. The Hood Group showed a greater number of supply vessels of varices compared to the Conventional Group. Among the supply vessels, the short gastric vein (SGV), cardiac plexus (CP), and parietal branch (PB) were conspicuously frequent in the patients in the Hood Group. Finally, we compared the non-recurrence. We observed the clinical course for more than 90 days after discharge in 81 out of 102 patients in the Conventional Group, and 90 out of 99 patients in the Hood Group. In both groups, we assessed the cumulative non-recurrence probability for up to 3000 days. As shown in Fig. 3, the non-recurrence probability of the Hood Group was statistically superior when compared with the Conventional Group ($p < 0.01$).

Discussion

In Western countries, the main treatment strategy for esophageal varices used to be medication such as beta-blockers[12)-13)]. Recently, EVL has been widely accepted as established procedure[14)]. In Japan, EIS used to be the main strategy for prophylactic therapy starting from the 1980s[15)]. But once EVL had been established, the main axis gradually shifted to EVL for its simplicity and lowered incidence of complications[14),16)]. However, in terms of recurrence rate and difficulty of retreatment[17)], EIS is thought to be superior to EVL. Therefore, it is still important to brush up on the skills necessary to perform EIS.

Accurate intravariceal injection may sometimes be difficult even for a skilled endoscopist when the form of varix is F0 or F1. The reasons for the difficulty are as follows. (1) In the lower esophagus, especially near the esophagogastric junction (EGJ), the space is usually narrow because the esophagus curves. (2) Accurate puncture is often disturbed by peristalsis, synchrony with heartbeat, and hard breathing of the patient. (3) A lot of air has to be supplied to secure the visual field during intravariceal injection. One tip is to insert the needle almost parallel to the varix. But in the lower esophagus, the angle between the needle and varix tends to be obtuse, and sufficient space to perform EIS tends to be restricted due to flexion of the esophagus. Retention of the needle becomes more and more unstable due to peristalsis and belching induced by released air. Consequently, spontaneous shedding of the needle occurs unintentionally, resulting in extravariceal injection.

It is important to block all supply vessels including parietal branches and the cardial plexus to eradicate esophageal varices and to prevent post-EIS recurrence[17)-19)]. To accomplish successful thrombosis, it is necessary to puncture accurately and to hold the needle as long as possible during EOI injection. The hood technique enables us to keep the lumen easily even in the lower esophagus, and it helps alleviate the effect of mucosal vibration and peristalsis. Thus, a transparent hood makes fine varix punctures easier and more accurate. The rates of CR were 75.5% in the Hood Group and 79.6% in the Conventional Group. There was no statistical significance between two groups. Rather, the result was slightly better in the Conventional Group. We consider that this can be attributed to the difference in the mucosal coagulation method. In the Conventional Group, the method of coagulation of the esophageal mucosa was M-BPEC in 87 cases (85.3%) and APC in 15 cases (14.7%). On the other hand, in the Hood Group, APC was used in all cases. In our department, mainly M-BPEC had been performed before APC was introduced. We have reported the effectiveness of M-BPEC in the eradication of varices[10)-11),20)-22)]. M-BPEC, compared to APC, may contribute to better results, especially in regard to the rate of CR.

Although the rate of CR was almost the same in the two groups, the rate of cumulative variceal recurrence was significantly lower in the Hood Group. We consider that this is because our oblique transparent hood enables easier intravariceal injection and better supply vessel occlusion especially of CP and PB. In fact, as presented in Table 5, total number of CP and PB contrasted in varicealography was larger in the Hood Group. Variceal recurrence and concomitant variceal re-bleeding may sometimes be fatal in cirrhotic patients[23)]. The evidence that our hood technique brought a lower incidence of recurrence will contribute to better prognosis and cost-effectiveness[24)]. Horigome[25)] and Murakami[26)] have reported the efficacy of a transparent hood for EIS. The former developed and used an original straight type hood with a rectangular slit. The latter developed and used an original straight type hood with a concave slit. Both groups developed the slit to fix the varix. In both hoods, the slit was adjusted to the channel hole of endoscope so that the varix was fixed in the slit of the hood. Their original transparent hoods contributed not only to proper maintenance of an expanded visual field but also to fixation of the endoscope at a puncture point. Unlike their hoods, we adapted a commercially-based oblique type transparent hood which was developed for EMRC. There is a notch on this hood, but this is for the purpose of fixing a high-frequency EMR snare. We do not use this notch for the fixation of varices, but it may help to guide the needle at a puncture point. The novelty is that we used a wide oblique transparent hood whose shortest part is 8 mm and longest part is 14 mm, and not a straight type hood. During the procedure of EIS, the shortest part is coincident with the puncture point and the longest part is coincident with the contralateral esophageal mucosa. This oblique form prevents the contralateral mucosa from disturbing the visual field. Oblique hoods in general help ensure a wider lumen than straight hoods.

The advantages of our hood are summarized as follows. (1) The hood contributes to a wide visual field even where there is flexion. (2) This reduces the influence of peristalsis, and helps to hold the needle at a variceal point more easily. (3) This contributes to a reduction of air release during EIS. (4) This can be used for hemostasis of a varix by pressing a bleeding point. On the other hand, the weak points of our hood are as follows. (1) Insertion is more painful. (2) There is a concern about hurting the pyriform sinus. (3) Mucus and blood that are trapped in the hood can sometimes disturb the visual field. We think we can prevent the insertion problem by handling the endoscope gently. It is very important never to push the scope under resistance. We are sometimes annoyed by mucus entering the hood. To prevent this problem, we always bear in mind that frequent suction of the mucus pooled at the upper esophagus and in the stomach is required, but this is still insufficient. A hood with a groove and hole is often used when performing endoscopic submucosal dissection (ESD) for the purpose of discharging liquid out of the hood. If we improve our hood by making a groove and hole on it, this problem might be solved. I believe this is a future issue for our hood technique.

This study has two limitations. First, this is a retrospective study, not a prospective study. Second, the effect of ARB and beta-blockers cannot be ignored in analyzing the variceal recurrence rate[27)-28)]. In both groups we should have excluded the cases in which either ARB or a beta-blocker was prescribed. We could not investigate all the details of medications in the Conventional Group due to destruction of the medical sheets. However, we were able to investigate all the medications in the Hood Group. Either ARB or a beta-blocker was administrated in 20 cases in the Hood Group. Even if we assessed the cumulative non-recurrence probability between the Conventional Group and the remaining 79 cases in the Hood Group, the statistical superiority of the Hood Group remained unchanged ($p = 0.0306$). We are sure we can prove the effectiveness of our hood technique as well.

In conclusion, the use of an oblique transparent hood improved the rate of intravariceal injection, the rate of enhanced supply vessels, and especially rate of variceal recurrence. Our hood technique makes it easier to perform intravariceal EIS even for trainees because it provides a better visual field. We believe that this transparent hood will contribute to broader usage of EIS.

Conflict of Interests

The authors declare no Conflict of Interests for this article.

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