

## Improvement of Cecal Insertion Using an Extra-Flexible Small-Diameter Colonoscope, CF-SV

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### ABSTRACT

Cecal insertion is the primary step for successful colonoscopy. However, incomplete access can sometimes occur because of adhesion or rigidity of the sigmoid colon. Such difficulties cannot always be resolved even if a pediatric-type colonoscope is used. In the present study, we applied an extra-flexible thin colonoscope, the CF-SV, for patients in whom insertion was difficult. Over a period of about 30 months, 3802 colonoscopic examinations involving total insertion were attempted. During this period, complete insertion was successful with the CF-SV in 34 (79%) of 43 patients in whom insertion of a pediatric scope (PCF-240I) had failed. In addition, during the same period, 79 patients, who were thought to have risk factors for use of a regular scope, or for whom the CF-SV was considered preferable, were examined using the CF-SV from the outset. Complete insertions were successful in 61 (77%) of these patients. Our experience in this series suggests that use of the CF-SV can facilitate complete insertion even in difficult cases.

**Key words :** total colonoscopy, complete insertion, adhesion, abdominal surgery

### INTRODUCTION

The aim of colonoscopy is to visualize the entire colon, and therefore cecal insertion is a necessary first step. However, cecal insertion may be quite difficult in some patients, such as those with adhesions due to previous abdomi-

nal surgery or rigidity of the sigmoid colon due to diverticulosis. In such cases, pain and structural narrowing may disturb deep insertion of the colonoscope. Pain can be partially reduced by sedation, but a colonoscope of regular diameter may not be able to pass through zones of structural narrowing. In order to reduce pain and ensure passage

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through areas where the lumen is narrow, a pediatric-type colonoscope has been employed, and this has considerably improved the success rate of deep insertion<sup>1)</sup>. However, insertion is still incomplete in some patients, even if pediatric-type colonoscopes are employed.

The CF-SV extra-flexible colonoscope (Olympus, Tokyo, Japan), which is the thinnest among currently available colonoscopes, has been on the market for over ten years<sup>2)</sup>. The CF-SV is thinner and more flexible than pediatric-type colonoscopes. As the CF-SV was originally designed to be a safe and easily handled sigmoidoscope for primary physicians, it has a shorter working length of 1030 mm, compared with 1330 mm for a regular colonoscope. Because of these specifications, except for its working length, the CF-SV would possibly be advantageous for passage through the sigmoid colon in the presence of adhesion or rigidity. Therefore, using the CF-SV, we have attempted complete insertion through the cecum for patients in whom insertion of a pediatric-type colonoscope has failed. In addition, as the CF-SV is expected to facilitate safer and less potentially damaging insertion, we have also applied it as a first choice for high-risk patients, such as those of very advanced age, those with severe inflammatory bowel disease, or in children.

## METHODS

The specifications of the CF-SV, two pediatric-type colonoscopes (PCF-P240AI and PCF-240I; Olympus, Tokyo, Japan), and a representative regular colonoscope (CF-230) are described in Table 1. The CF-SV is the thinnest (9.6 mm in diameter) and most flexible of currently available colonoscopes; it

Table 1. Specifications of representative colonoscopes.

Scope	Top (mm)	Shaft (mm)	Length (mm)
CF-SV	9.6	10.0	1030
PCF-P240AI	10.3	10.5	1330
PCF-240I	11.2	11.1	1330
CF-230	13.2	12.9	1330

Top, diameter of the scope top; Shaft, diameter of the scope shaft; Length, working length of the scope. CF-SV is the thinnest and most flexible. However, the working length of the CF-SV is 300 mm shorter than that of a common scope.

has a regular channel and is applicable for biopsy or polypectomy. However, it has a working length 300 mm shorter than the other models (Fig. 1).

During a 30-month period between January 2004 and June 2006, we carried out screening colonoscopy with the aim of complete insertion in 3,802 patients. All colonoscopies were performed by the one-man method, without fluoroscopy or sedation. We routinely used pediatric-type colonoscopes, the PCF-240I in 92% of cases and also the PCF-P240AI in 5%. In the remaining 3%, other types of colonoscope were used. During the study period, we finally decided to employ the CF-SV in 122 patients, who were the subjects of this study (Table 2). These patients were divided into two groups. In the first group (re-insertion group), PCF-series colonoscopes were employed at the beginning of the examination, but deep insertion had to be abandoned due to pain or structural narrowing, necessitating use of the CF-SV in order to continue the examination. Thirty-nine of 43 patients in the first group had a history of abdominal surgery, including gynecological treatment or appendectomy. In the second group (first choice group), use of the CF-SV was decided at the outset because of

## Improvement of insertion using CF-SV

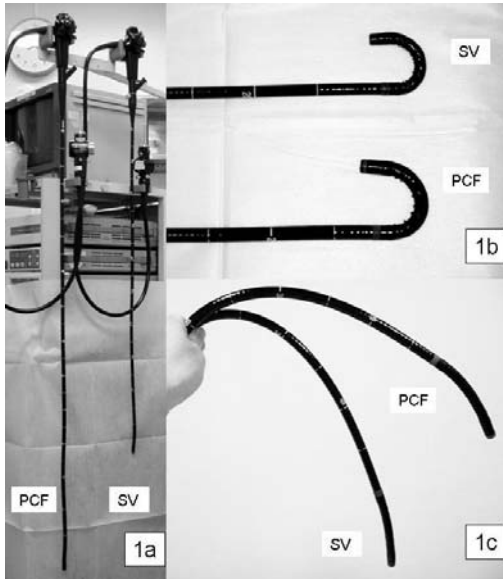


Fig. 1. Comparisons between the CF-SV and the regular pediatric-type colonoscope PCF-240I

- a: the CF-SV is 300 mm shorter than the PCF-240I.  
 b: the CF-SV is thinner and can turn in a smaller circle than the PCF-240I.  
 c: the pediatric-type colonoscope PCF-240I is originally flexible rather than regular-type colonoscopes. Moreover, the CF-SV is the most flexible among the colonoscopes.

very advanced age, very young age, severe emaciation, severe inflammatory bowel disease, or adhesion, about which information had been obtained at previous examinations.

## RESULTS

The rate of complete insertion in the first group (re-insertion) was 79% (34 /43), and we were able to salvage these 34 difficult cases (Table 3). In the second group (first choice group), the complete insertion rate was similar at 77% (61 /79). During the study period, we did not experience any serious accidents such as perforation or peritonitis as a result of using the CF-SV.

Table 2. Patients undergoing total colonoscopy using the CF-SV.

	Re-insertion (n=43)	First choice (n=79)
Adhesion etc.	39	61
Inflammatory bowel disease	1	6
Child (<5 yr)	0	3
Others	3	9

Re-insertion means that the CF-SV was employed after failing with the PCF-240I. First choice means that the CF-SV was used from the outset. Adhesion etc. includes diverticulosis, previous abdominal surgery, ovarian tumor and old tuberculosis. Others include the very elderly, patients with emaciation, or high-risk cases (graft versus host disease, malnutrition, or inflammatory bowel disease, etc.).

Table 3. Rates of complete insertion using the CF-SV.

	Complete insertion	
Re-insertion (n=43)	34	(79%)
First choice (n=79)	61	(77%)

Re-insertion means that the CF-SV was employed after failing with the PCF-240I. First choice means that the CF-SV was used from the outset.

The reasons for unsuccessful insertion were usually pain, rigidity or inability to control the adhesive loop in the sigmoid colon. In just two cases, the procedure had to be abandoned at the hepatic flexure because of shortness of working length.

## DISCUSSION

The issue of how to achieve complete insertion of a colonoscope in every patient is an old, but still unresolved one. Even recent articles continue to discuss factors associated with incomplete colonoscopy<sup>3)</sup> or techniques in patients that have been referred due to prior incomplete insertion<sup>4)</sup>. New trends in the

manufacture of colonoscopes have focused on high performance such as high-resolution imaging and magnification. Although these functions are very important, such high-performance scopes have regular, or wider, diameters. Also, if complete insertion is not achieved, they are not able to work. During colonoscopy with a regular-diameter shaft scope, it is difficult to pass through segments where there is structural narrowing due to adhesion or rigidity. Sedation will partially reduce the degree of pain or discomfort, but will not necessarily allow a scope to be advanced through a region of structural narrowing. The latest development to assist colonoscopy in difficult cases is the double balloon endoscope<sup>5)</sup>. This offers a good approach for an adhesive or extra-long colon. However, the over-tube for the double balloon endoscope has an outer diameter similar to that of a regular colonoscope, which may make it disadvantageous for passage through segments of structural narrowing.

On the other hand, a colonoscope with a small diameter sacrifices high performance (high resolution and magnification), but is naturally advantageous for insertion into the proximal colon<sup>1), 2), 6), 7)</sup>. A small diameter can increase the likelihood of passage through the rigid angle of the sigmoid colon, and a soft shaft will decrease the degree of potential damage and pain. The CF-SV is the thinnest of small-diameter colonoscopes such as the PCF series. In an experimental study, Uno et al. evaluated the relationship between the stiffness of a colonoscope and perforation risk. As the CF-SV guarantees a safe examination, the risk of perforation is extremely low<sup>8)</sup>.

Previously, Han et al. reported the usefulness of the CF-SV for deep insertion<sup>9)</sup>. They

compared the CF-SV with the CF-230, which is a regular-diameter colonoscope, and concluded that the CF-SV was very advantageous for deep insertion. However, their actual rate of complete insertion was not so high. In contrast to their study, our complete insertion rate using the CF-SV was supposed to be relatively high.

In the present study, we actually experienced that re-insertion of the CF-SV contributed to finding early ascending colon cancer (Fig.2). This time, we evaluated only improvement of insertion rate when the CF-SV was applied. In future, we must precisely evaluate performance of the CF-SV, involving multiple clinical view points.

Colonoscopy is generally performed using gentle pushing and sufficient pull-back. The sigmoid colon should be shortened by right-rotation, and thereafter must be kept straight for deep insertion. At the proximal side of the hepatic flexure, the transverse colon should also be shortened by pulling back the scope and aspirating unnecessary air. When manipulating the CF-SV, these basic techniques are similar, but there are some definite differences. The shaft of the CF-SV is very soft, we therefore the scope must be handled extremely slowly and gently. At the splenic (about 40 cm from the anus) or hepatic (about 60 cm from the anus) flexure, use of a stylet and posture change are effective for achieving passage. The main disadvantage of the CF-SV is its short working length. Fortunately, however, this was the reason for incomplete insertion in only a few cases. However, a CF-SV with a regular working length was considered desirable for more versatile usage.

We still employ the CF-SV as a first choice for patients of very advanced age, those with

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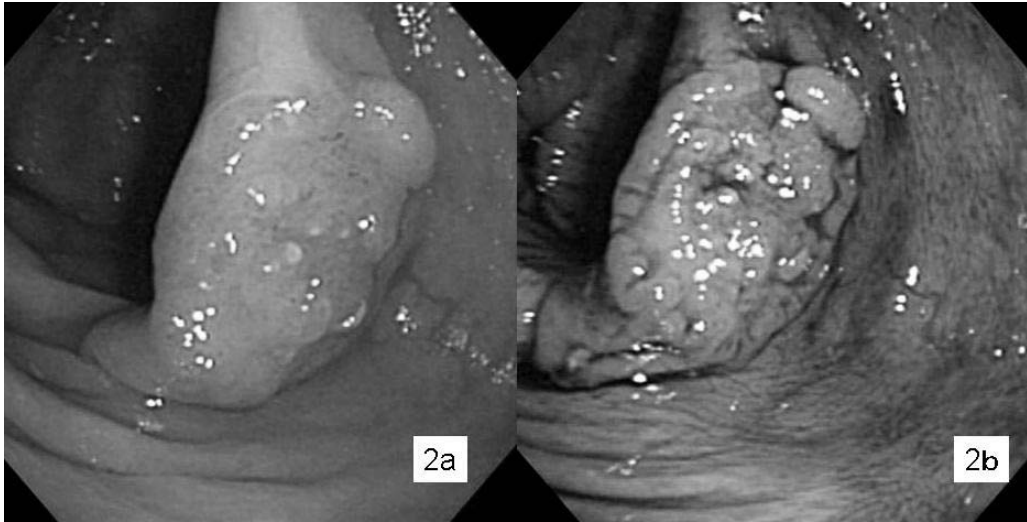


Fig. 2. Endoscopic observations of early cancer lesion in the ascending colon using the CF-SV a: regular observation and b: observation after spraying blue dye. This lesion was fortunately found by reinsertion of the CF-SV, after failure of deep insertion by the PCF-240I. Resolution of pictures which were observed by the CF-SV is not so high, but clinically acceptable.

malnutrition or severe inflammatory bowel disease, and also for children. In such patients, our rate of complete insertion was not so high, being 77%. However, the CF-SV was thought to help reduce the degree of risk in weak patients. If we had used another type of scope, the complete insertion rate might have been lower.

### CONCLUSION

We have demonstrated that the rate of complete insertion in patients with an adhesive or rigid sigmoid colon can be improved using the CF-SV. In addition, our experience suggests that the CF-SV might be the first choice of scope for weak patients or those at high risk. The CF-SV is advantageous not only for patients with adhesion or high risk, but can also facilitate complete insertion in difficult cases.

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