Techniques for ... Extracting Bile Duct Stones

Features of the Memory 8-Wire Basket

Figure 1: Memory 8-Wire Basket

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Introduction

Endoscopic sphincterotomy (EST) and subsequent removal of stones is a well-established treatment for bile duct stones. This procedure is currently performed all over the world, and it is recognized as much more convenient and much less invasive than surgical procedures. However, in practice, stone removal is sometimes difficult and time consuming. I am introducing here my technique using a Cook Medical Memory 8-wire basket for stone extraction after EST.

I. Extraction Devices

Baskets and balloon catheters are usually used for the removal of common bile duct stones. Baskets are generally used for stone extraction in Japan, but balloon extraction catheters are also used for this purpose, especially to remove small stones and biliary sludge.

Currently, various types of baskets are commercially available, and standard 4-wire baskets seem to be the most popular in the world. However, I prefer to use an 8-wire basket with a spiral form (See Figure 1: Memory 8-Wire Basket), because it offers several advantages as stated later, as well as a wire-guided version for special situations.

II. Steps of Stone Removal

1 *Insertion of Extraction Devices*

Currently, we use a wire-guided sphincterotome. After EST, we usually remove the wire guide with the sphincterotome. However, I recommend that beginners leave the wire guide in the bile duct. In cases with a peri-ampullary diverticulum, sometimes the incision cannot be made sufficiently, and the opening also sometimes collapses into the diverticulum. In this situation, insertion of extraction devices is difficult. Especially in multiple stone cases, repeated cannulations are complicated and take time. However, the collapse of the opening can be prevented by leaving a wire guide in place, making it easier to insert extraction devices into the bile duct.

2 *Capturing the Stone*

The most basic technique of capturing a stone with a standard 4-wire basket is to advance the catheter until upstream of the stone, then pull the catheter back slowly after opening the basket. Stone capture is accomplished by moving the catheter up and down in the vicinity of the stone. If the stone seems to be drawn into the basket, the basket can be moved up and down to verify that the stone has really entered it, then slowly closed to secure the stone. At this step, if the stone is grasped too tightly, it may break into many fragments, which would make subsequent removal complicated and difficult. Therefore, careful attention should be paid in closing the basket gently to avoid breaking the stone.

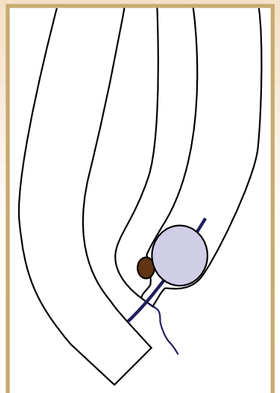

Figure 3: Stones are sometimes caught at the inferior extremity, and cannot be removed using a balloon.

If the stone is quite small (less than 4 mm in diameter), capturing it with a standard 4-wire basket is often difficult. In Japan, a balloon extraction catheter is often used in such situations instead of a basket. However, this is sometimes difficult because the stone can get caught on the inferior extremity of the bile duct (Figure 3). To avoid this situation, we prefer to use a Memory 8-wire basket. The Memory 8-wire basket is suitable for capturing stones because it is shaped like a net. In practice, after opening the basket upstream of the stone, the stone is usually captured by simply pulling back on the catheter with the basket opened. Once the stone is captured, it is easy to keep it in the basket. This makes it very easy to remove the stone from the papilla with the basket opened.

On the other hand, this benefit turns into a shortcoming in some situations. Special attention should be paid in cases with a large stone as well as with multiple stones, because it is much more difficult to release stones from a Memory 8-wire basket. To prevent basket impaction, this basket should not be used in cases with large stones (probably larger than 15 mm in diameter). In addition, in cases with multiple stones, each stone should be removed one after the other, starting with the lowest stone. However, if the stones are extremely small, it can be used in a similar manner to a single stone case (see Figures 4-A, 4-B, 4-C).

Figure 4-A

Figure 4-B

Figure 4-C

3 *Removing the Stone from the Papilla*

Several maneuvers are performed to remove a stone from the papilla, and all or some of these are carried out simultaneously. The first is simply pulling back on the basket catheter. If the incision of the EST is sufficient and the stone is not too large, it can be extracted from the papilla with this operation alone. However, more often than not, additional steps must be taken. This involves deflecting the scope's tip away from the papilla while applying traction to the basket catheter. Concrete steps include: (1) releasing the up angle of the scope (switching from the down angle); (2) pushing the scope forward; and (3) turning the scope clockwise (the most effective step). (See Figure 5) If the stone cannot be removed even when these maneuvers are repeated, the remaining method is to remove the basket together with the scope itself. However, since this applies force in a completely different direction from the axis of the bile duct, operators must be aware of the risk of lacerating the papilla, as well as the possibility of injuring the bile duct and the pancreas. This last method should be avoided if at all possible.

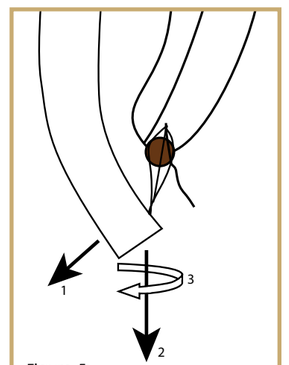

Figure 5:
(1) Release the up angle
(2) Push the endoscope forward
(3) Turn the endoscope clockwise

TECHNIQUES FOR EXTRACTING BILE DUCT STONES
Continued on page 11

Continued from page 5

Techniques for ...
Extracting Bile Duct Stones
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4 Releasing the Captured Stone

In cases with multiple stones, it is necessary to insert the extraction device into the bile duct repeatedly to remove the stones, each time releasing the captured stone in the duodenum. Stones can be released relatively easily with a standard 4-wire basket by opening the basket completely and shaking the stones out by moving the catheter back and forth quickly. However, when a Memory 8-wire basket is used, it is difficult to release the stones using only this method. In such cases, one should press the tip of the basket against the duodenal wall beside the papilla with the basket fully opened. This maneuver opens the basket elliptically, with the basket wires coming away from the stone. As a result, the stone can be released easily by closing the basket in this position. (Figure 6).

Figure 6:
Press the basket against the duodenal wall and release the stone

Although more difficult, the same technique can be used to release a stone from a Memory 8- wire basket in the bile duct by pressing the basket's tip against the bile duct wall.

Conclusion

I have introduced the technique to remove bile duct stones using a Memory 8-wire basket. I hope that these techniques are helpful for beginners.