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Management of migrated plastic biliary stents in patients with benign biliary diseases

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ABSTRACT

Introduction: Biliary stenting using plastic stents is widely used in the treatment of benign and malignant disorders of pancreaticobiliary system. Despite widespread use of plastic biliary stents, migration occurs in 5–10 patients undergoing biliary stenting. Migration may lead to complications and endoscopic retrieval of migrated plastic stents may be challenging for the endoscopists. The aim of the study was to determine migration rates of biliary stents, complications related to migration and endoscopic retrieval techniques, and success rates in patients with benign biliary disorders.

Materials and Methods: Medical records of 1653 ERCP procedures performed between December 2016 and May 2021 were retrospectively examined. Indications for stenting, presentation of migration, length and diameter of the stents, endoscopic retrieval techniques, and success rate were analyzed.

Results: There were 295 plastic stents inserted for benign biliary disorders in 211 patients. Migration occurred in 11.4% of cases; 5.7% distal migration and 5.7% proximal migration. While cases with proximal migration mostly presented with cholangitis, most cases were asymptomatic with distal migration. Endoscopic retrieval success rate was 100% in proximally migrated plastic biliary stents. In one case, cholangioscopy-assisted retrieval was used as a rescue therapy. As most of the distally migrated stents passed through the intestine spontaneously, endoscopic retrieval was not required.

Conclusion: Migration of stents is an undesirable condition but endoscopic retrieval may be achieved with a high success rate in experienced centers using the available equipment properly. Cholangioscopy-assisted stent retrieval may be used as a rescue therapy if conventional methods are unsuccessful.

Keywords: Biliary stents, endoscopic retrieval, migration

Introduction

Endoscopic biliary stent insertion is a well-established and widely used modality for maintaining bile flow in both benign and malignant conditions such as irretrievable choledocchal stones, benign biliary strictures, malignant biliary strictures, and post-operative biliary leaks.[1-3]

Two classes of biliary stents are available: Plastic (made of Teflon, polyurethane or polyethylene) and metallic stents. While plastic stents are cheaper, easier to remove, or exchange, they are more prone to clogging and stent occlusion causing cholangitis.[4] Most of the plastic biliary stents have a slightly curved shaft and flaps near each end (Amsterdam type) to prevent proximal or distal migration.

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[5] Despite this architecture, either proximal or distal stent migration occurs in 5–10% of patients.[6]

Although distal migration of plastic biliary stents leads to complications such as duodenal perforation, colonic diverticular perforation, and impaction of stent in caecum,[7-9] distal migration is usually not problematic as biliary stents pass through the intestine silently. Therefore endoscopic retrieval is seldomly required and it is easy and successful if required.[10] However, proximally migrated plastic biliary stents require endoscopic retrieval which may be technically difficult and sometimes unsuccessful.[5]

In this study, we aimed to determine the migration rates of plastic biliary stents, complications related to migration and also to evaluate the endoscopic retrieval techniques, and success rates in a tertiary care hospital.

Materials and Methods

Patients

We retrospectively examined medical records of all endoscopic retrograde cholangiopancreatography (ERCP) procedures performed between December 2016 and May 2021 in a tertiary care hospital. Most of the patients with malign diseases did not show up after stent insertion, probably due removal of stent at surgery (i.e., Whipple operation) or death. Hence, patients with malignancy related stent insertions were not included in the study.

Stenting indications, stent length, diameter, presenting symptoms and complications related to migrated stent, number of migrated stents, direction of migration (proximal or distal), and techniques used to retrieve the stents were obtained from medical records.

Proximal migration was considered if the distal end of the stent was not endoscopically visible at the ampullary orifice but the stent was seen in the biliary tree on cholangiography. Distal migration was considered if the stent was situated below the original position or was no longer present on either endoscopic or fluoroscopic examination.

ERCP Procedure and Retrieval of Migrated Stents

Written informed consent was taken from all of the patients before ERCP procedures. Deep sedation was maintained by an anesthesiologist during the procedure using midazolam or propofol infusions. Hyoscine N-butylbromide was used to decrease intestinal motility. All procedures were performed by experienced physicians using a side-viewing duodenoscope with a working channel of 4.2 cm (Fujifilm, Japan). Before the insertion of the stent endoscopic sphincterotomy was performed on a routine basis to facilitate the advancement of the stent.

Plastic stents and center bend shaped with two flaps near each end (Micro-Tech, Nanjing, China) were used for stenting purposes.

Equipment Used for Stent Retrieval

Triple lumen extraction balloon (Boston Scientific, Marlborough, USA), tapered type catheter (Boston Scientific, Marlborough, USA), hydrophilic coated guide wires 0.025, 0.0035 inches (Cook Medical, Bloomington, USA), polypectomy snares (Micro-Tech, Nanjing, China), lithotripter basket (Fujifilm medwork, Höchstadt, Germany), triple lumen sphincterotome (Leomed, Changzhou City, China), rat tooth forceps (Fujifilm medwork, Höchstadt, Germany), and SpyGlass Direct Visualization Syste (Boston Scientific, Marlborough, Mass, USA).

Techniques

Direct and indirect techniques were used for retrieval of proximally migrated plastic biliary stents. Fluoroscopic guidance was used for maneuvers during stent retrieval. Successful retrieval is defined as pulling the distal end of the stent out of the ampullary orifice into the duodenal lumen so that the subsequent removal becomes possible. In case of failed retrieval, another stent was inserted to maintain bile flow.

Balloon technique

Stone extraction balloon is inflated above or the alongside the migrated stent and the balloon catheter is pulled down so that the distal end of the stent comes out of the ampullary orifice.

Dormia basket technique

A closed Dormia basket is advanced in to the bile duct and passed beyond the distal end of the stent. Then, the basket is opened and moved up and down until the distal end of the stent enters between the strings of the basket. Once the stent is inside the strings, basket is closed and pulled down cautiously in a straight configuration out of the ampullary orifice.

Balloon and basket technique

This technique is used if the migrated stent is pulled down by extraction balloon but the distal end could not be taken out from the ampullary orifice. In this case, stent is captured by the basket and taken out.

Snare over in-stent wire guide technique (Lasso technique)

In this technique, migrated stent in the biliary duct is cannulated with wire guide. Then, a polypectomy snare is advanced over the wire guide and the stent is trapped in the snare. Snare holding the stent is withdrawn and the migrated stent comes out (Fig. 1).

Direct traction with snare or rat tooth forceps

This technique is used if the distal end of the migrated stent is close to the ampullary orifice. Distal end of the stent is grasped with snare or rat tooth forceps.

Cholangioscopy-assisted balloon retrieval

We used this technique as rescue therapy in one patient in whom direct and indirect retrieval techniques failed under fluoroscopic guidance. Proximal end of the stent was seen in the right intrahepatic biliary duct by cholangioscopy. After advancing a 25 French wire guide to this branch, cholangioscopy was withdrawn leaving the wire guide in the duct. Then, an extraction balloon was advanced above the proximal end of the stent and inflated. Inflated balloon was pulled down until the distal end of the stent was visible at the ampullary orifice. Then, balloon was deflated and pulled out. Finally, distal end of the stent was captured using a snare passing through the working channel of duodenoscope.

Statistical Analysis

All statistical analyzes were performed using IBM SPSS for Windows version 20.0 (SPSS, Chicago, IL, USA). Numeric variables were presented depending on a normal distribution with either mean±standard deviation or median. Categorical variables were summarized as counts (percentages).

Results

In the study, period 1653 ERCP procedures were performed in our tertiary care hospital. A total of 564 plastic biliary stents were inserted during this period; 295 and 269 stents

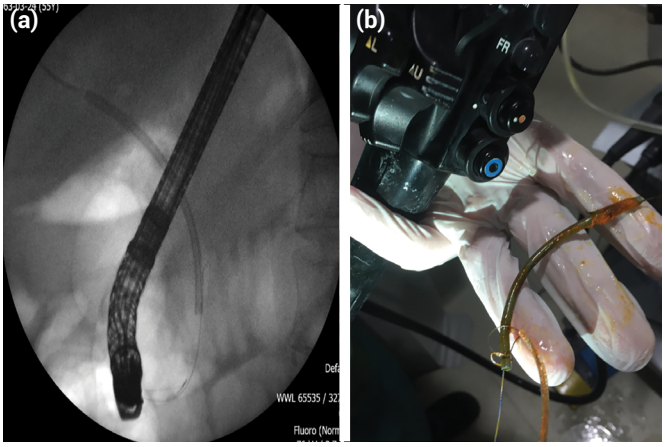

Figure 1. (a) Wire guide passing through the proximally migrated stent **(b)** Stent taken out of the biliary tract.

for benign and malign diseases, respectively. Patients with benign indications for biliary stent insertion were included in the study: 66 cases were lost to follow-up so they were not included in the statistical analyzes.

Two most common benign indications for biliary stenting were unretrievable bile duct stones and benign biliary strictures, 61% and 24.7%, respectively. Other indications are given in Table 1.

Total migration rate was 11.4% . Proximal and distal migration occurred in 13 (5.7%) and 13 (5.7%) cases, respectively (Table 2). In 203 (88.6%) cases, there was no migration.

Cases with proximal migration presented mostly with cholangitis (7, 39%), 5 cases (38.5%) were asymptomatic and noticed on scheduled follow-up ERCP procedure. Cases with distal migration were mostly asymptomatic (Table 2).

Proximal migration occurred in 5 cases (38.5%) with benign biliary strictures and in 8 cases (61.5%) with unretrievable choledochal stones. There were similar findings in cases with distal migration (Table 2).

Proximal migration occurred with relatively shorter stents (6, 7, and 8 cm); distal migration also occurred more with short stents. Regarding longer stents (10, 11, 12, and 14 cm) distal migration were more common than proximal migration. Diameter of the stents was similar for both proximal and distal migration (Table 2).

Endoscopic retrieval of proximal migrated plastic biliary stents was successful in all cases with proximal migration. Stone extraction balloons, Dormia baskets, polypectomy snares and guidewires, and combination of any of these were used for retrieval. One session for stent re-

Table 1. Baseline demographics and stenting indications of patients with benign biliary diseases

Age, mean±SD	63.43±16.92	
	n	**%**
M/F	112/99	53.1/46.9
Number of plastic stents inserted in benign disease	295	
Indications for stenting in benign diseases		
Benign biliary stricture	71	24.7
Unretrievable stones	180	61.0
Post-operative biliary leak	18	6.1
Type 3 perforation	1	0.3
Post ERCP pericholangitic abscess	1	0.3
Post-transplant stricture	15	5.1
Delayed drainage of contrast medium	5	1.7
PSC related dominant stricture	2	0.7
Mirizzi's syndrome	2	0

ERCP: Endoscopic retrograde cholangiopancreatography; PSC: Primary sclerosing cholangitis.

trieval was adequate in 10 cases. In two cases, two ERCP sessions were required for retrieval using stone extraction balloon. The most challenging retrieval case was a 34-year-old male patient who presented with cholangitis in 84 months after the stent insertion. Three sessions of ERCP procedures were required for stent retrieval. At the third session under the guidance of cholangioscopy, stent retrieval was possible. No complication was encountered during retrieval sessions.

Most of the distally migrated stents passed through the intestine spontaneously. In one case, distal migration the stent led to duodenal wall perforation and was managed by over-the scope clip application. Two stents touching the duodenal wall were retrieved by rat tooth forceps. Another stent was trapped in ileocecal valve and removed by snare in a colonoscopy procedure (Table 2).

Discussion

In recent studies, stent migration rates vary between 4.14% and 13.5%.[6,10-12] In our study, total migration rate of plastic biliary stents was 11.4% (5.7% proximal and 5.7% distal). We may postulate that migration of plastic biliary stents occurs at an acceptable rate in our center.

There are conflicting results about the presentation of patients with migrated stents. In the study by Katsinelos et al.,[10] all patients with proximal migration were symptomatic at presentation. In another report, most of the patients with biliary stent migration were asymptomatic and noticed during scheduled stent exchange procedures.[11] In our study, most of the patients with proximal migration were symptomatic at presentation. On the other hand, distal migration was noticed mostly during scheduled procedures.

We found that shorter stents have a tendency to migrate proximally and longer stents distally. Arhan et al.[11] reported a similar finding. With regard to stent diameter, we cannot comment on the relationship with migration because we mostly use 10 French (F) stents and naturally most of the migrated stents were 10 F in diameter.

The success rate of retrieving the proximally migrated plastic biliary stents is reported to be 90–100% in the literature; in most cases, the stent can be retrieved in first sessions, second or third sessions are seldomly needed.[5,6,11,12] We also achieved 100% success rate in our cases. In 10 cases, retrieval was achieved in the first session; in two cases two sessions and in one case three sessions were required.

Balloon technique is more applicable in cases with non-dilated or mildy dilated choledochus. It is difficult to apply balloon technique in markedly dilated choledochus because inflated balloon cannot effectively cover the lumen and the stent may easily escape from the balloon. In dilated choledochus, migrated stents can be effectively retrieved using Dormia baskets because basket opens adequately in dilated ducts. The advantage of basket over the snare is multiple wires of the basket which increases the possibility of capturing stent, in contrast to snare which

Table 2. Features associated with migrated stents

	Proximal migration		Distal migration	
	n	%	n	%
Number of migration	13	5.7	13	5.7
Presentation				
Asymptomtatic	5	38.5	8	61.5
Cholangitis	7	53.9	5	38.5
Jaundice	1	7.6	0	
Migration with regard to stenting indication				
Benign biliary stricture	5	38.5	4	30.8
Unretreivable stone	8	61.5	8	61.5
Post-cholecystectomy biliary leak			1	7.7
Length of the migrated stent(cm)				
6	6	46.2	5	38.5
7	3	23.1	1	7.7
8	3	23.1	2	15.4
10		-	2	15.4
11		-	1	7.7
12	1	7.7	1	7.7
14		-	1	7.7
Diameter of the migrated stent(French)				
7	1	7.7	1	7.7
10	12	92.3	12	92.3
Retrieval techniques				
Cholangioscopy assisted	1	7.7		
Stone extraction balloon	3	23.1		
Dormia basket	3	23.1		
Lasso method	3	23.1		
Basket and balloon combination	1	7.1		
Snare	2	15.4	1	7.7
Forceps			3	23.1
Spontaneous passage through the intestine			9	69.2

has only one loop.[5] We used basket effectively in cases with dilated choledochus.

Lasso technique or "snare over in-stent wire guide" technique first described by Sherman et al.[13] is usually applied for the retrieval of proximally migrated pancreatic duct stents.[14] This technique is more challenging in the choledochus. Because the pancreatic canal is narrow and it is easier to cannulate the stent with the guidewire. However, as the diameter of the choledochus is larger, it is difficult to cannulate the migrated biliary stent. Furthermore, in the case of a long standing biliary stent, the lumen of the stent is occluded by plugs, which makes it impossible to pass the guidewire through the stent lumen. We used this technique in slightly dilated choledochus if the migrated stent could be cannulated with a guidewire passing through.

The major concern when using rat tooth forceps is the potential risk of injury to the duct because forceps may capture the tissue instead of the stent.[5] In cases where we used rat tooth, we confirmed that the forceps captured the stent under fluoroscopic guidance and did not encounter any complications.

Conventional retrieval techniques are performed under fluoroscopic guidance, or in other words in a semi-blind

manner. On the other hand, cholongioscopy offers the direct visualization of the biliary ducts and proximally migrated biliary stents. Undoubtedly direct visualization makes retrieval of proximally migrated biliary stents much easier and faster. There are numerous reports of successful retrieval of proximally migrated using cholangioscopy.[15-17] Due to high costs and reimbursement issues, we reserve cholangioscopy only for the cases with prior failed attempts at retrieval of migrated stents. That is why we do not use cholangioscopy routinely for stent retrieval.

Clinicians should be aware of this study that has certain limitations when interpreting this study. First limitation of this study is its retrospective design. Besides, the number of cases with migrated stents included in this study is relatively small. Therefore, independent risk factors for stent migration could not be defined. Designing multicenter prospective studies in the future will help to define the independent predictors more accurately. As we conducted this study in tertiary care hospital, it will not be appropriate to generalize our results to the general population. Despite these limitations, we shared our clinical experience over a 5-year period including cholangioscopy guided retrieval. It should be noted that cholangioscopy is not widely available in our country.

Conclusion

Migration of plastic biliary stents is not rare. Endoscopic retrieval is always necessary for proximally migrated plastic stents and can be achieved by using suitable techniques and equipment in experienced hands. In case of failed attempts of retrieving proximally migrated plastic stents using conventional techniques, cholangioscopy-assisted retrieval may solve the problem. Distal migration of stents is usually silent but endoscopic retrieval is feasible when needed.

Disclosures

Ethichs Committee Approval: The study was approved by the Kocaeli University Non-interventional Clinical Research Ethic Committee (Date: 27/01/2022, No: KÜ GOKAEK-2022/02.20).

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