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Progressive biliary dilation via percutaneous transhepatic access for benign biliary strictures associated with cholecystectomy. Long-term results

Dilatación biliar progresiva por acceso transhepático percutáneo para estenosis biliares benignas asociadas a colecistectomía. Resultados a largo plazo

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Palabras clave: *afección, biliar, estenosis, benigna, dilatación, percutánea.*

ABSTRACT

Introduction: post-cholecystectomy bile duct injury is the most common cause of benign biliary stricture. Surgical diversion through a hepaticojejunostomy has shown the best outcomes; however, approximately 13% of cases will progress to stenosis of the diversion. In this scenario, percutaneous dilation protocols exist to restore the patency of the anastomosis. **Material and methods:** we report a series of cases of progressive bile duct dilation via percutaneous transhepatic access in patients with benign biliary stenosis associated with hepaticojejunostomy secondary to post-cholecystectomy bile duct injury. **Results:** 14 patients with biliary stenosis associated with post-cholecystectomy bile duct injury were included in a progressive bile duct dilation via percutaneous transhepatic access protocol over 13 years (2004-2017). With an average follow-up of 43 months (12 to 192), 11 patients (78.6%) maintained biliary patency, while 3 patients (21.4%) developed re-stenosis of the hepaticojejunostomy, diagnosed 22 months after the end of the dilation protocol (3 to 33). **Conclusion:** the progressive bile duct dilation via percutaneous transhepatic access technique is effective in resolving benign bile duct strictures in 78.6% of cases in long-term follow-up.

RESUMEN

Introducción: *la afección de vía biliar postcolecistectomía es la causa más común de estenosis biliar benigna. El tratamiento que ha mostrado los mejores resultados es la derivación quirúrgica a través de una hepato-yeyuno-anastomosis; sin embargo, alrededor de 13% de los casos evolucionarán con estenosis de la derivación. Ante este escenario, existen protocolos de dilatación percutánea como una estrategia para recuperar la permeabilidad de la anastomosis.* ***Material y métodos:*** *se reporta una serie de casos de dilatación biliar progresiva por acceso transhepático percutáneo en pacientes con estenosis biliar benigna asociada a hepato-yeyuno-anastomosis secundaria a afección de vía biliar postcolecistectomía.* ***Resultados:*** *14 pacientes con estenosis biliar asociada a afección de vía biliar postcolecistectomía fueron incluidos en un protocolo de dilatación biliar progresiva por acceso transhepático percutáneo a lo largo de 13 años (2004-2017). En un seguimiento promedio de 43 meses (12 a 192), 11 pacientes (78.6%) mantienen permeabilidad biliar, mientras que tres pacientes (21.4%) evolucionaron con reestenosis de la hepato-yeyuno-anastomosis, la cual se diagnosticó 22 meses después del término del protocolo de dilatación (3 a 33).* ***Conclusión:*** *la técnica de dilatación biliar progresiva por acceso transhepático percutáneo es efectiva para resolver las estenosis benignas de los conductos biliares en 78.6% de los casos en un seguimiento de largo plazo.*

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INTRODUCTION

Benign biliary strictures are a condition that may be due to inflammatory or post-surgical processes. They require multidisciplinary evaluation and management, where treatment goals will be to alleviate the symptoms of biliary obstruction, preserve liver function and recover patency of the affected duct for as long as possible.[1]

The most frequent cause of benign biliary strictures is postcholecystectomy biliary tract disease (PCBD). Its incidence is estimated between 0.4 and 1.33%,[2,3] with Roux-en-Y hepatojejuno-anastomosis (HYA) being the treatment that has shown the best long-term results according to the type of condition considering the Bismuth classification. However, about 13% of HYA will develop recurrent stricture[4,5] and up to 40% when the confluence has been lost.[6,7] Radiological, endoscopic, and surgical interventions are available to restore biliary patency.

Radiological interventions by percutaneous access have undergone a continuous evolution. In 1921, Professor Burckhardt in Germany described for the first time the radiological visualization of the biliary tract by puncture of the gallbladder. In 1978, Molnar reported the first case series of percutaneous transhepatic balloon dilatation (PTBD),[8] and in 1986, Mueller reported the first large case report with 76 patients.[9] Since then, the percutaneous transhepatic approach has been positioned as an alternative to surgical remodeling with a less invasive body; however, it requires, as a necessary condition, the introduction of a biliary catheter that manages to cross the stenosis, which is not always achieved.

The objective of the percutaneous dilatation protocol is, in most cases, to achieve secondary biliary patency in patients with a history of a bilioenteric bypass who have evolved with stenosis.[10] However, it is occasionally possible to achieve primary biliary patency in patients with AVBPC without a previous attempt at repair.

MATERIAL AND METHODS

We present a retrospective observational study of patients with a history of AVBPC and secondary stricture who underwent a progressive biliary dilatation protocol by percutaneous transhepatic access (DBPATP) developed at the *Hospital General de México* (HGM), over 13 years (2004 and 2017).

The DBPATP protocol consists of the installation of a mixed biliary catheter, i.e., one that manages to frank the stricture and place fenestrae in both the biliary and intestinal lumen *(Figure 1)*, usually with an initial diameter of 8.5 or 10 Fr that is replaced every two months by a larger French (Fr) (2 Fr of advance per session) until reaching a variable diameter depending on the stenosed duct, 14 Fr if it is only a right or left duct and between 18 and 22 Fr if it is the confluence. The catheter is kept closed because its mixed position allows biliary flow into the intestine through the fenestrations and is only opened when cholangitis is suspected.

Adequate biliary patency is thought to have been achieved in cases where there is a functional biliary tree, without endoprosthesis, without the need for invasive interventions, without post-treatment cholangitis, without hepatic abscess, without jaundice or external biliary fistula. It is considered primary biliary patency if it is achieved after an index treatment (surgery or dilatation) and secondary biliary patency if it is completed after the failure of

Figure 1: *Percutaneous transcatheter cholangiography of left bile duct bypass with mixed placement (up to duodenum).*

Table 1: Patients with exclusion criteria.

Criteria	n (%)
Short-term follow-up*	2 (16.7)
Did not attend follow-up (untraceable)	2 (16.7)
Still in the process of dilatation	6 (50.0)
Technical failure	2 (16.7)
Total	12 (100.0)

* The dilatation protocol came to term with biliary patency demonstrated by cholangiography, but follow-up is <12 months.

a previous intervention as in the case of our patients.[11]

The procedure can be performed under sedation or general anesthesia. Antisepsis of the right costal region is performed, the puncture site will generally be at the level of the posterior axillary line, at a variable height between the eighth and tenth intercostal space, depending on the diaphragmatic ablation and having as a priority to avoid pleural lesions. Simple lidocaine is infiltrated at 2%, and with the assistance of ultrasound and fluoroscopy, a fine 21 or 22 g Chiba needle is punctured, which advances. At the same time, the contrast medium is injected until accessing a branch of the right hepatic duct. A 0.018 g Cope-type platinum-tipped guidewire is introduced through the needle using an introducer system. The needle is removed, and a 5 Fr plastic dilator is passed, sliding over the guidewire, which is replaced by a larger gauge to favor the passage of the dilator through the obstructed area. Finally, a metal positioner is used to place a multifenestrating catheter that advances to the small bowel.

In all cases, biliary stricture was suspected clinically by jaundice or biochemically by cholestasis and confirmed by direct cholangiography by percutaneous access, magnetic resonance imaging (MRI), or endoscopic retrograde cholangiopancreatography (ERCP). We excluded patients in whom the catheter was positioned externally, that is, where the stricture was not crossed, and its location was exclusively in the bile ducts, and those with a follow-up of fewer than 12 months from the end of the intervention. Cases of stenosis due to malignant etiology were not considered.

The duration of the intervention was defined as the time elapsed from the placement of the first biliary catheter to the removal of the last one. Technical failure was those cases in which a dilatation protocol was initiated but not completed due to persistent stenosis or inability to advance the catheter caliber.

Patients who developed restenosis or technical failure underwent surgical remodeling.

RESULTS

In 26 patients a percutaneous biliary catheter was placed in a mixed position in the context of AVBPC with secondary stenosis with the aim of recovering biliary patency; 14 of them were considered for the final analysis and 12 had exclusion criteria *(Table 1)*.

Technical failure occurred in two patients (16.7%), due to inability to progress the catheter caliber in one case, and intrahepatic lithiasis in another, so they abandoned the dilatation protocol after an average of eight months (six and 10) and underwent surgical remodeling.

Of the final sample (n = 14), three patients were male (21.4%) and 11 (78.6%) were female, with a mean age of 40.5 years (range 26 to 69 years). The initial level of the condition was classified as Bismuth 1 to 3 in 11 patients (78.6%), 4 in two patients (14.3%) and 5 in one patient (7.1%). One case with type 4 condition required double catheterization due to stenosis of both sectoral ducts. The duration of the dilatation protocol was 19.9 months on average, with a range of 9 to 49 months.

In 11 patients (78.6%) long-term biliary patency was achieved, with an average follow-up of 43 months (range 12 to 192 months), while in three patients (21.4%) restenosis occurred after an average of 21.5 months (3 to 33 months) following the end of the dilatation protocol *(Table 2)*.

In the cases in which biliary patency was achieved, the most frequent antecedent was a stenosis of an HYA performed by AVBPC (9/81.8%), of which, stenosis at the level of the biliary confluence was the most common (6/54.5%), followed by stenosis of the CHD (2/18.2%), and of both ducts in one patient with

double bypass (1/9.1%). In two patients (18.2%) primary biliary patency was achieved in the presence of AVBPC without a previous repair attempt. The duration of the intervention was 21.4 months (nine to 45), with a mean of 6.2 catheters required (four to eight). Cases where the dilatation target was sectoral conduits (right or left), the maximum caliber was 14 Fr, and 18 or 22 Fr when the target was confluence *(Table 2)*.

Most patients achieved grade B patency (n = 5/45.4%), followed by grade C patency (n

Table 2: Patients with successful DBPATP protocol.

Age	Sex	History	Intervention duration (months)	Total catheters	Final diameter	Type of patency	Degree of patency	Follow-up (months)
26	Female	HYA due to AVBPC/CHD stenosis	21	6	18 Fr	PS	C	18
54	Male	HYA due to AVBPC/confluence stenosis	19	6	18 Fr	PS	C	30
38	Female	AVBPC Bismuth 5	17	8	22 Fr	PP	A	48
27	Female	Double HYA shunt by AVBPC with loss of confluence/CHD stenosis	16	4	14 Fr	PS	B	21
31	Male	Double HYA shunt for AVBPC with loss of confluence/ stenosis of both conduits (required 2 catheters)	12	6/6	18/18 Fr	PS	B	22
30	Female	HYA due to AVBPC/confluence stenosis	21	6	18 Fr	PS	C	24
62	Female	HYA due to AVBPC/confluence stenosis	12	7	20 Fr	PS	B	27
47	Female	HYA due to AVBPC/confluence stenosis	16	8	22 Fr	PS	B	20
40	Female	HYA due to AVBPC/confluence stenosis	48	8	22 Fr	PS	D	192
42	Female	AVBPC Bismuth 2	45	6	16 Fr	PP	D	12
39	Male	HYA due to AVBPC/confluence stenosis	9	4	22 Fr	PS	B	72

DBPATP = progressive biliary dilatation by percutaneous transhepatic access. HYA = Hepato-jejunum-anastomosis.
AVBPC = postcholecystectomy bile duct involvement. CHD = right hepatic duct. Fr = French. PS = secondary patency. PP = primary patency.

Table 3: Patients with unsuccessful DBPATP protocol.

Age	Sex	History	Intervention duration	Total catheters	Final diameter	Cause of failure	Interval (months)
64	Female	AVBPC Bismuth 3	16	8	22 Fr	Restenosis	30
40	Female	HYA by AVBPC	16	8	22 Fr	Restenosis	33
69	Female	HYA by AVBPC	11	5	16 Fr	Restenosis	3

DBPATP = progressive biliary dilatation by percutaneous transhepatic access.
AVBPC = postcholecystectomy bile duct involvement. HYA = Hepato-jejunum-anastomosis. Fr = French.

= 3/27.3%), grade D (n = 2/18.2%) and grade A (n = 1/9.1%).

In the cases that evolved with restenosis (3/21.4%), the duration of the intervention was 14.3 months (11 to 16), with a mean of seven catheters required (five to eight) and a final diameter of between 16 and 22 Fr *(Table 3)*.

DISCUSSION

Since their inception in 1895, percutaneous approach procedures have offered an exceptional window into the comprehensive management of patients through diagnostic and therapeutic procedures. Using needles, guidewires, and catheters directed by ultrasound, tomography, or fluoroscopy, it is possible to route instruments through the body to specific areas, offering an alternative to a surgical approach with less body invasion.[12]

They are now a fundamental part of the multidisciplinary approach to AVBPC patients. The aim is to achieve secondary biliary patency in patients with a history of bilioenteric shunting who have evolved with stricture. However, occasionally, it is possible to attain primary biliary patency in patients with AVBPC without a previous attempt at repair. The standard protocol consists of DBTP percutaneous transhepatic biliary dilatation, which is performed with serial high-pressure balloon cholangioplasty and a catheter that is maintained throughout the procedure both for radiological control and to keep the access route for future sessions. The number and interval of these sessions are determined by institutional preference. The literature reports an average of between two and 7.8 sessions per patient, with intervals of six to 12 weeks between each one, and a duration of the intervention with an extensive range between 1.1 and 19.9 months. The incidence of restenosis is 13.2 to 39%, which increases proportionally with follow-up time.[12-19]

Some groups have implemented interventions of short duration, with three sessions over five days, removing the biliary catheter after the last session. The results have been discouraging, with new strictures of 59% at three years.[20] Yun et al.[21] reported a variant with a temporary metallic stent with coverage, which migrates spontaneously and is expelled without any intervention, achieving superior results compared to those achieved with balloon angioplasty regarding restenosis (13 vs 54.5%).

To date, no technique ensures long-term biliary patency. Percutaneous dilatation eventually leads to restenosis because once the cholangioplasty has been performed, a new scarring process is stimulated because of the aggression to the tissues. This is why at MGH, we have opted to maintain a transanastomotic biliary catheter that is replaced by a progressively wider caliber, as an attempt to ensure that scar remodeling always develops limited by the caliber of the catheter. In addition, each new cholangioplasty progresses little concerning the diameter reached in the previous procedure, thus seeking minimum aggression to the tissues with each session.

The duration of the intervention with the DBPATP technique should be less than 21 months in its most extensive variant. It starts with an 8.5 Fr caliber catheter and ends with a 22 Fr catheter, with three-month intervals and a total of seven replacements. However, the patient's ability to achieve this continuity was inconsistent, so the intervention time was considerably extended.

We have achieved good long-term results with this technique, like those obtained by other authors. However, it is difficult to contrast the experience between groups due to the lack of a standardized definition of biliary patency in the context of dilatation protocols. This definition should consider clinical and biochemical variables, the need for reinterventions, and a minimum temporal delimitation, as the definition of a successful intervention may differ between groups.

In 2018, Dr. Strasberg et al.[11] proposed a definition of biliary patency applicable to surgical, endoscopic, and radiological interventions to facilitate comparison between approaches and centers. Under this definition, which we have adopted in this report, biliary patency does not allow the presence of jaundice, cholangitis, hepatic abscesses, external fistulas or the need for new interventions.

The follow-up period should be considered a fundamental variable when determining the incidence of restenosis when evaluating a dilation strategy, with an inversely proportional relationship between follow-up time and the success of the intervention. Since restenosis occurred on average 14.3 months after the end of the intervention, we considered it most correct to exclude patients with a follow-up of less than 12 months, thus showing a realistic expectation of long-term success.

No variant in the percutaneous dilatation techniques has shown reliable superiority, and in all cases, there is a risk of restenosis. Therefore, the existence of a standard technique cannot be concluded. In this case series, we present a variant in the dilatation technique, with which we have achieved good long-term results, although the number of patients is small.

CONCLUSION

Based on the results of this research, we can say that the DBPATP technique is effective in resolving benign bile duct strictures in 78.6% of cases at long-term follow-up.

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