

## W Technique for Biliary Anastomosis in Liver Transplantation

Julio Cesar Wiederkehr<sup>1\*</sup>, Henrique A Wiederkehr<sup>2</sup>, Bruna Olandoski Erbano<sup>2</sup>, Barbara A Wiederkehr<sup>2</sup> and Caroline A de Carvalho<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Surgery, Federal University of Parana, Brazil

<sup>2</sup>Medical Students from Faculdade Evangélica do Parana, Curitiba, Parana, Brazil

\*Corresponding author: Julio Cesar Wiederkehr, Rua da Paz, 195, Sala 508, 80060-160 Curitiba-PR, Brazil, Tel: 55 41 9972-5887; E-mail: julio.wieder@gmail.com

Received November 10, 2014, Accepted December 17, 2014, Published December 19, 2014

Copyright: © 2015 Wiederkehr JC, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

### Abstract

Biliary anastomoses in Orthotopic liver transplantation (OLT) are considered technically arduous and are accountable for the majority of OLT surgical complications. In this 'How I do It' article, we present a new biliary anastomosis technique. It has been performed in our service since 2011 in more than 300 liver transplants. In our series, 5.7% of the patients submitted to duct-to-duct anastomosis with a follow-up greater of 6 months developed biliary complications. Future studies should enhance this surgical technique, in order to minimize the OLT complications.

**Keywords:** Biliary Anastomosis; Liver Transplantation

### Introduction

In the past several years, orthotopic liver transplantation (OLT) techniques have been greatly improved, dramatically reducing OLT mortality rates [1,2].

However, biliary anastomosis still remains the "Achilles' heel of OLT", being responsible for the majority of OLT surgical complications [2]. The complication rate for biliary anastomosis ranges from 6.5% to 15% and considerably impairs OLT results [2-4].

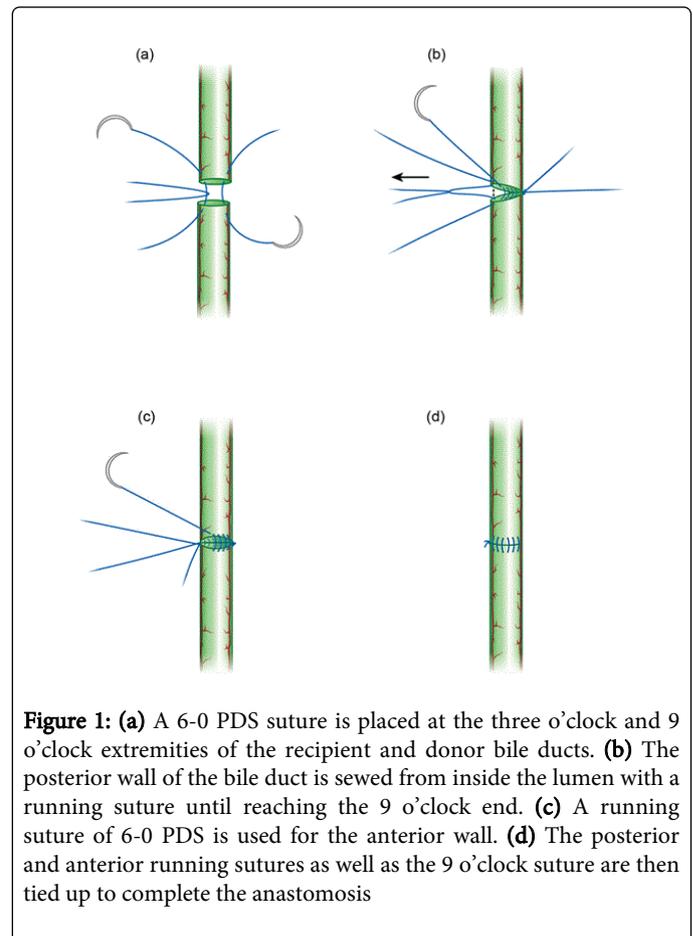
Biliary reconstruction during OLT is generally performed by end-to-end choledocho-choledochostomy (CC) or Roux-Y choledocho-jejunostomy (CRY). Both are considered standard techniques [5]. However, CC is the most commonly employed technique and is preferred for healthy patients, while CRY is usually used in patients with preexisting biliary tract disease or patients who have undergone a previous biliary tract surgery [2,6,7].

Biliary complications can be classified as bile leaks (early and late), bilomas, bile duct strictures (anastomotic and non-anastomotic) and bile duct filling defects and can also occur following vascular complications, such as ischemia. Biliary leaks and strictures are responsible for 70% of all biliary complications [3]. Although the pathogenesis of biliary stenosis is multifactorial, anastomotic stenosis is most closely associated with surgical technique, while non-anastomotic stenosis is generally associated with graft ischemia [8]. However, it is known that in most cases leaks and strictures occur at the site of anastomosis [2].

As previously described by Seiler et al. the classical end-to-end biliary anastomosis usually begins with a "6 o'clock" thread and finishes at "12 o'clock" [2]. Since OLT complications are frequently related to biliary anastomosis and the majority of these complications are associated with surgical technique OLT surgeons must improve their anastomosis skills to reduce the incidence of biliary complications [2-4,9].

This study shows that a new biliary anastomosis technique employed in our service since 2011 has improved our rate of complications related to anastomosis technique.

### Technique



**Figure 1:** (a) A 6-0 PDS suture is placed at the three o'clock and 9 o'clock extremities of the recipient and donor bile ducts. (b) The posterior wall of the bile duct is sewed from inside the lumen with a running suture until reaching the 9 o'clock end. (c) A running suture of 6-0 PDS is used for the anterior wall. (d) The posterior and anterior running sutures as well as the 9 o'clock suture are then tied up to complete the anastomosis

A 6-0 PDS suture is placed at the three o'clock and 9 o'clock extremities of the recipient and donor bile ducts (Figure 1a). The 3 o'clock suture is then tied up. A 3-0 silk tie is placed inside the nine o'clock suture, creating a loop, and then pulled up. A "w" figure is formed in the 9 o'clock suture. This keeps the two edges of the bile duct separated from each other. The posterior wall of the bile duct is sewed from inside the lumen with a running suture until reaching the 9 o'clock end (Figure 1b). A running suture of 6-0 PDS is used for the anterior wall (Figure 1c). The posterior and anterior running sutures as well as the 9 o'clock suture are then tied up to complete the anastomosis (Figure 1d).

## Results

This technique has been employed in our service since 2011 in more than 300 liver transplants. The preferred biliary tract reconstruction technique is duct-to-duct anastomosis. Only 5.7% of the patients submitted to duct-to-duct anastomosis with a follow-up greater of 6 months developed biliary complications.

## Discussion

For the classical technique, the literature reports rates of complications related to anastomosis ranging from 6.5% to 15% [2,3]. Seiler et al. described the classical end-to-end biliary anastomosis technique as follows [2]. Suturing begins at 6 o'clock with a 6.0 PDS and needles on both ends, and the thread is tied in its middle. The anastomosis is completed by sewing the 'three o'clock' and 'nine o'clock' circumference with a running suture technique and tying both ends of the threads together at 'twelve o'clock'. For both the classic technique and our technique, the ducts are first dorsally adapted. However, we prefer to start the anastomosis by placing the threads at 'three o'clock' and 'nine o'clock' to anchor the bile ducts and stably handle the structures.

In addition to the classical biliary anastomosis technique, another technique has been reported: the "parachute anastomosis". In this technique, the sutures are not pulled immediately after the threads pass by the biliary wall [10]. It has been primarily employed in the cardiovascular surgery field [11]. In 2002, Yoshimi et al. began using this technique for biliary anastomosis [12]. The good short-term results encouraged the use of the parachute technique in cases of biliary anastomosis. However, this technique has some inconveniences. Excessive tension and rough manipulation can result in pulling the suture line through the biliary wall [10]. Additionally, when pulling the thread, it may not easily slide through the duct wall. Thus, a nerve hook may be necessary to help tighten the suture line; otherwise, the anastomosis may be loose [10].

The essential component of this novel anastomosis technique is to place the 3-0 silk tie inside the nine o'clock suture, the w-stay suture. This creates a loop and keeps the two edges of the bile ducts separated from each other. This step makes the closure simpler, by facilitating the view of the donor and recipient's bile duct wall, allowing for safer handling and a more accurate placement of the stitches.

The use of a T-tube in OLT is controversial. Although some studies encourage its use, others favor the abandonment of the T-tube in OLT, affirming lower rates of complications [13-15]. In a meta-analysis, the authors pooled the outcomes of 1027 patients undergoing OLT performed by CC, with and without the use of a T-tube [16]. Both groups had equivalent outcomes for anastomotic bile leaks and fistulas and equivalent mortality rates due to biliary complications. However,

the "without T-tube" group had fewer episodes of cholangitis and peritonitis and showed a trend of fewer overall biliary complications. A recent study advocated that the use of a T-tube should be reserved to cases of risky anastomosis and for bile ducts of less than 7 mm in diameter, not as a routine technique for all OLT cases [17]. The biliary anastomosis technique described in our study does not require the use of a T-tube and can be employed even for cases of risky anastomosis and very small bile ducts. Thus, the use of the "w-technique" may reignite the discussion of the use of a T-tube in OLT, even for selected cases described by López-Andújar et al. [17]. In our series we did not use a T-tube.

There is a consensus that biliary ducts are difficult to manage. Because the biliary duct is particularly small, some authors have even suggested that microsurgical equipment should be used in OLT [18]. Fernández-Aguilar et al. also consider the necessity of having a biliary tutor on the surgical team [19]. Our technique does not change the biliary anastomosis main principles; rather, it is an improvement of the surgical management that aims to facilitate the anastomosis procedure for OLT surgeons.

## Conclusion

Biliary anastomosis remains the "Achilles' heel of OLT", being responsible for the majority of complications related to this surgery. The main causes of OLT complications are related to the surgical technique employed; thus, improvements in anastomosis management are welcome. This study described a new technique of biliary anastomosis that mixed characteristics of the classical with the parachute anastomosis technique and increased the feasibility of anastomosis. The goal of this technique is to simplify the handling of the biliary duct as well as the overall view of the anastomosis to help OLT surgeons. Future studies should aim to further improve the technique described here, until biliary anastomosis is no longer the main cause of complications during OLT.

## References

1. Gomez R, Moreno E, Castellon C, Gonzalez-Pinto I, Loinaz C, et al. (2001) Choledochocholedochostomy conversion to hepaticojejunostomy due to biliary obstruction in liver transplantation. *World journal of surgery* 25:1308-12.
2. Seiler CA (1999) The bile duct anastomosis in liver transplantation. *Dig Surg* 16: 102-106.
3. Greif F, Bronsther OL, Van Thiel DH, Casavilla A, Iwatsuki S, et al. (1994) The incidence, timing, and management of biliary tract complications after orthotopic liver transplantation. *Ann Surg* 219: 40-45.
4. Colonna JO 2nd, Shaked A, Gomes AS (1992) Biliary strictures complicating liver transplantation. Incidence, pathogenesis, management, and outcome. *Annals of surgery* 216:344-50.
5. Testa G, Malagò M, Broelsh CE (2001) Complications of biliary tract in liver transplantation. *World J Surg* 25: 1296-1299.
6. Valera-Sanchez Z, Flores-Cortes M, Romero-Vargas ME, Gómez-Bravo MA, Pareja-Ciuró F, et al. (2006) Biliodigestive anastomosis in liver transplantation: review of 13 years. *Transplant Proc* 38: 2471-2472.
7. Akamatsu N, Sugawara Y, Hashimoto D (2011) Biliary reconstruction, its complications and management of biliary complications after adult liver transplantation: a systematic review of the incidence, risk factors and outcome. *Transplant international : official journal of the European Society for Organ Transplantation* 24: 379-92.
8. Moreno González E, Alvarado A, Gómez R, González-Pinto I, Loinaz C, et al. (1994) Cold ischemia time and biliary complications in liver transplantation. *Transplant Proc* 26: 3546.

9. O'Connor TP, Lewis WD, Jenkins RL (1995) Biliary tract complications after liver transplantation. *Arch Surg* 130: 312-317.
10. Hoballah JJ. *Vascular Reconstructions: Anatomy, Exposure and Techniques*: Springer; 2000.
11. Ochi M, Tanaka S (1994) Arterial graft anastomosis in coronary surgery: side by side stitch with parachute technique. *Kyobu Geka* 47: 360-363.
12. Yoshimi F, Ikeda M, Oka D, Asato Y (2002) Reconstruction of small bile ducts using a parachute technique. *Hepatogastroenterology* 49: 1213-1215.
13. Gastaca M, Matarranz A, Muñoz F, Valdivieso A, Aguinaga A, et al. (2012) Biliary complications in orthotopic liver transplantation using choledochocholedochostomy with a T-tube. *Transplant Proc* 44: 1554-1556.
14. Weiss S, Schmidt SC, Ulrich F, Pascher A, Schumacher G, et al. (2009) Biliary reconstruction using a side-to-side choledochocholedochostomy with or without T-tube in deceased donor liver transplantation: a prospective randomized trial. *Ann Surg* 250: 766-771.
15. Scatton O, Meunier B, Cherqui D, Boillot O, Sauvanet A, et al. (2001) Randomized trial of choledochocholedochostomy with or without a T tube in orthotopic liver transplantation. *Ann Surg* 233: 432-437.
16. Sotiropoulos GC, Sgourakis G, Radtke A, Molmenti EP, Goumas K, et al. (2009) Orthotopic liver transplantation: T-tube or not T-tube? Systematic review and meta-analysis of results. *Transplantation* 87: 1672-1680.
17. López-Andújar R, Orón EM, Carregato AF, Suárez FV, Herraiz AM, et al. (2013) T-tube or no T-tube in cadaveric orthotopic liver transplantation: the eternal dilemma: results of a prospective and randomized clinical trial. *Ann Surg* 258: 21-29.
18. Lin TS, Concejero AM, Chen CL (2009) Routine microsurgical biliary reconstruction decreases early anastomotic complications in living donor liver transplantation. *Liver transplantation : official publication of the American Association for the Study of Liver Diseases and the International Liver Transplantation Society* 15: 1766-75.
19. Fernández-Aguilar JL, Santoyo J, Suárez Muñoz MA, Sánchez Pérez B, Pérez Daga A, et al. (2007) [Biliary reconstruction in liver transplantation: is a biliary tutor necessary?]. *Cir Esp* 82: 338-340.