Early outcomes of standard lymphadenectomy in laparoscopic pancreaticoduodenectomy for periampullary cancer

Le Quan Anh Tuan[1,2], Pham Minh Hai[2]

1. University of Medicine and Pharmacy at Ho Chi Minh City, 2. University Medical Center at Ho Chi Minh City

Corresponding author:
Pham Minh Hai
University Medical Center at Ho Chi Minh City
215 Hong Bang Street, Ward 11, District 5, Ho Chi Minh City
Mobile: 0909 757 820
Email: hai.pm@umc.edu.vn

Received date: 21/7/2023
Accepted date: 13/9/2024
Published date: 30/9/2024

Abstract

Introduction: The quality of lymph node dissection plays an important role in laparoscopic pancreaticoduodenectomy for periampullary cancers and significantly affects the patient's survival. Among the degrees of lymphadenectomy, the standard level is routinely performed in a range of centers. Therefore, it is necessary to evaluate the results of standard lymphadenectomy in laparoscopic pancreaticoduodenectomy for periampullary cancers.

Patients an Methods: This is a cross-sectional study. We analyzed the data from 65 cases witnessing laparoscopic pancreaticoduodenectomy with standard lymphadenectomy due to periampullary cancers from February 1st, 2017 to January 31st, 2022, at University Medical Center at Ho Chi Minh City.

Results: The average number of harvested lymph nodes was 16.6 ± 5.1. Positive lymph node happened in 50.9% of cases and mean of lymph node ratio (LNR) was 0.11. Three most common metastatic groups were group 13, 14 and 17. Intraoperative bleeding happened in 1 patient (1.5%) because of portal vein tear during lymph node dissection and postoperatively chylous fistula occurred in 2 cases, making up 3.1%. The case of intraoperative bleeding was converted to open surgery to control the bleeding. The patient was going well and discharged on the 8th day after surgery. The two cases of chylous fistula were also going well and discharged on the 22nd postoperative day.

Conclusion: Standard lymphadenectomy in laparoscopic pancreaticoduodenectomy can meet the requirements for the number of harvested lymph nodes in the principles of cancer treatment and having the low rate of complications related to lymph node dissection.

Keywords: lymphadenectomy, harvested lymph node, laparoscopic pancreaticoduodenectomy, periampullary cancer

Introduction

Periampullary cancers are defined as malignant lesions that arise within 2 cm of the ampulla of Vater. They include cancers arising at of ampulla of Vater, distal common bile duct, head of pancreas, and the second part of duodenum. Pancreaticoduodenectomy is the current mainstay of treatment for periampullary cancers. In the surgery, lymphadenectomy is an important step, affecting the quality of surgery and patients' survival. Studies showed that the quality of lymph node dissection is related to the rate of postoperative recurrence and metastasis[1,2]. Evidence from some studies, standard lymphadenectomy meets the quality requirements for lymph node dissection in pancreaticoduodenectomy for periampullary cancer and this model is also recommended to be performed routinely, while radical lymphadenectomy and extended lymphadenectomy should only be performed in selected patients[3].

Recently, many centers around the world have applied laparoscopic surgery in pancreaticoduodenectomy to treat periampullary cancers and this trend is becoming more and more popular. As applying laparoscopic surgery in pancreaticoduodenectomy, the effectiveness of standard lymphadenectomy is a matter of concern to many authors. There have been many studies evaluating the effectiveness of lymph node dissection in laparoscopic pancreaticoduodenectomy and revealing good results[4,5]. However, a few studies showed that the average number of harvested lymph nodes was less than required number[6,7].

Our study aimed to evaluate the outcomes of standard lymphadenectomy in laparoscopic pancreaticoduodenectomy for periampullary cancers. We hoped that this study would contribute additional data to the general database and also to evaluate the effectiveness of standard lymphadenectomy in laparoscopic pancreaticoduodenectomy in our center.

Patients and methods

This is a cross-sectional study. The study reports outcomes of standard lymphadenectomy of all patients who underwent laparoscopic pancreatico-duodenectomy due to periampullary cancers at the University Medical Center at Ho Chi Minh City for a period of 5 years, from February 1, 2017 to January 31, 2022. Research objectives included:

1. Determination of the average number of harvested lymph nodes by laparoscopic pancreaticoduodenectomy for periampullary cancer.

2. Determine the rate of complications related to lymph node dissection.

Indications for laparoscopic pancreaticoduodenectomy in our study were without vascular involving (superior mesenteric vessels, inferior vena cava and hepatic arteries), classification of ASA from I to III and no serious heart disease.

The lymph node dissection: we performed standard lymphadenectomy completely through laparoscopic approach during laparoscopic pancreatico-duodenectomy. The number of harvested lymph node stations were 12 as recommended by the consensus meeting of the International Study Group of Pancreatic Surgery in 2014 (ISGPS 2014)[3]. Details are presented in Table 1 and Figure 1.

Ethics: the curent study was approved by the ethics committee in biomedical research of the University of Medicine and Pharmacy at Ho Chi Minh City through 433/ĐHYD-HDĐD statement.

Table 1. Standard lymphadenectomy according to ISGPS 2014[3]

Lymph node station	Nomenclature of lymph nodes[8]
5, 6	Suprapyloric and infrapyloric lymph nodes
12b1, 12b2, 12c	Lymph nodes of the right side of the hepatoduodenal ligament
13a, 13b	Posterior pancreaticoduodenal nodes
14a, 14b	Nodes to the right side of the superior mesenteric artery from the origin of the superior mesenteric artery at the aorta to the inferior pancreaticoduodenal artery
17a, 17b	Anterior pancreaticoduodenal nodes

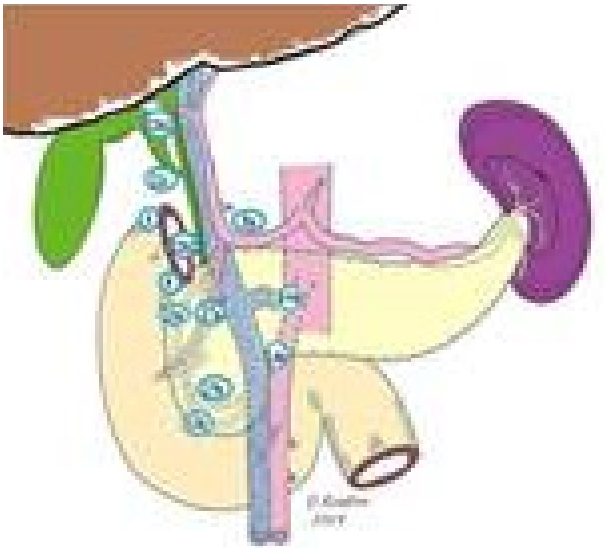

Figure 1. Harvested lymph nodes stations in standard lymphadenectomy

"Source: Kostov D, 2016 9"

Result

During 5 years, there were 65 patients undergoing laparoscopic pancreaticoduodenectomy for periampullary cancer with standard lymph node dissection. Patients' characteristics are presented in Table 2. More than half of the total cases in the study (58.5%) were carcinoma of the ampulla of Vater. Pancreatic head cancer accounts for about a quarter of cases (27.7%). Except for cases of duodenal cancer, the average tumor size of other sites was similar. Figures 2 and 3 illustrate lymphadenectomy at some lymph node stations in the current study.

Table 2. Patient characteristics (n = 65)

Variable	Result
Age	
Range	39 - 79
Mean	58,9 ± 8,9
Gender, n (%)	
Male	32 (49,2)
Female	33 (50,8)
BMI, kg/m^2	
Range	17,6 – 28,9
Mean	21,7 ± 2,5
ASA classification, n (%)	
I	13 (20)
II	37 (56,9)
III	15 (23,1)
History of previous abdominal surgery, n (%)	
Upper abdominal surgery	2 (3,1)
Lower abdomen surgery	5 (7,7)
Cancer location, n (%)	
Ampulla of Vater	38 (58,5)
Pancreatic head	18 (27,7)
Distal common bile duct	6 (9,2)
Duodenum	3 (4,6)
Tumor size (mm), mean (range)	
Ampulla of Vater	20,3 (5 – 50)
Pancreatic head	29,3 (20 – 42)
Distal common bile duct	18,5 (10 – 27)
Duodenum	70 (40 – 90)

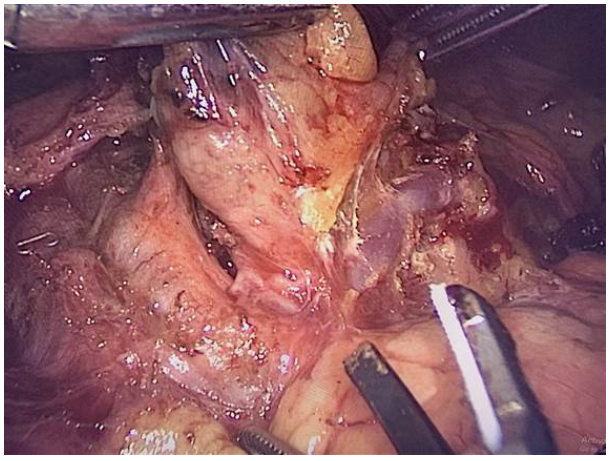

Figure 2. 8a, 12 stations lymphadenectomy

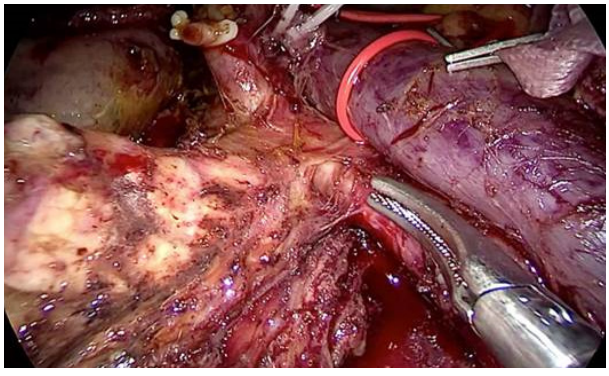

Figure 3. 14 station lymphadenectomy

Although laparoscopic pancreaticoduodenectomy with standard lymphadenectomy was performed in 65 cases, the data on the number of harvested lymph nodes in 3 cases did not match reality, so after data cleaning, the information on the number of lymph nodes in these cases was not included in the study sample. The mean of dissected lymph nodes of 62 patients was 16.6 and the standard deviation was 5.1. The minimum was 8 lymph nodes, and the maximum was 30 lymph nodes. The overall rate of positive lymph node was 50.9%. The lymph node – positive trend decreased from pancreatic head cancer (68.7%) to duodenal cancer (50.0%), then ampullary cancer (44.4%) and final in common bile duct cancer (37.5%). The mean of lymph node ratio (LNR) was 0.11. The data based on lymph node groups showed that metastasis was found in 6.9% of group 5and6; 5.5% of group 8; 6.0% of group 12; 25.4% of group 13; 7.2% of group 14, and 14.7% of group 17.

Intraoperative complications related to lymph node dissection occurred in 1 case (1.5%) due to bleeding from portal vein and must be converted to open surgery to control bleeding. There were 2 cases of chylous fistula after surgery, accounting for 3.1%. In one case, the chyme was drained well through an abdominal drainage tube, and conservative treatment was successful. Then, the drainage was removed and the patient discharged on the 22nd postoperative day. The second case required percutaneous drainage under ultrasound guidance. The patient also discharged on the 22nd postoperative day, and the drain was withdrawn on the 30th day.

Discussion

Lymph node metastasis is an important prognostic factor for patients with periampullary cancers, which is one of the bases for evaluating cancer stage and choosing a treatment plan after surgery. This is an important factor in multimodality treatment. Good quality of lymph node dissection will help assess lymph node metastasis more accurately. So far, there are 3 degrees of lymph node dissection in pancreaticoduodenectomy: standard lymphadenectomy, radical lymphadenectomy, and extended lymphadenectomy. In which, standard lymphadenectomy is recommended to be performed routinely, while the other two types of lymph node dissection should only be performed in some special cases[3]. As this recommendation, we carried out the standard lymphadenectomy for the candidates. Several randomized controlled trials have shown that extended and radical lymphadenectomy do not prolong survival compare to standard lymphadenectomy, but may increase complications such as chronic diarrhea and weight loss[3,10–12]. Furthermore, extensive dissection around the major vessels can cause bleeding and increase the likelihood of injury to these vessels. Consequently, serious complications will happen and the outcomes of surgery will deteriorate.

The quality of standard lymphadenectomy is expressed by the number of removed lymph nodes. Not only that, the number of lymph nodes also affects patients' long-term prognosis. Reports have shown that survival is proportional to the number of removed lymph nodes and proportional to the number of metastases in the total number of removed lymph nodes[13–15]. According to Tomlinson et al, patients' survival time with 15 or more harvested lymph nodes was longer than those less than 15 ones by 8 months ($p < 0.001$)[1]. In this study, the author retrospectively reviewed 3505 patients undergoing pancreaticoduodenectomy for pancreatic head cancer with no lymph node metastasis or only 1 lymph node metastasis (according to post-operative pathology results). Similarly, a retrospective analysis of 9945 patients with pancreaticoduodenectomy (2004-2013) by Wang et al showed that patients with less than 15 harvested lymph nodes (55.6% of the total) had a shorter postoperative survival time and the higher recurrent rate than who have 15 or more lymph nodes harvested[2]. An insufficient number of harvested lymph nodes will reduce the accuracy of cancer

staging because metastases may not be obtained, as a result, postoperative survival prognosis will also be inaccurate. According to the recommendation of The International Study Group of Pancreatic Surgery (ISGPS), the minimum number of lymph nodes required for standard lymphadenectomy in laparoscopic pancreaticoduodenectomy for periampullary cancers should be 15 lymph nodes[3]. The mean number of harvested lymph nodes in our study was 16.6, more than the recommended minimum level. Recent studies showed the similar outcomes (Table 3). As mentioned, effectiveness of lymphadenectomy is proportional to the number of metastases in the total number of removed lymph, therefore this variable as well as lymph node ratio are also important. Figures in our study were like the forementioned reports as well.

This study included a short-term follow-up. Although our study provided positive short-term outcomes of laparoscopic standard lymphadenectomy, we were unable to identify nodal metastasis over time. This is a limitation. Future studies should investigate long-term outcomes for this issue.

Table 3. Results on the number of harvested lymph nodes

Author	Year	Approach	Average number
Wang[6]	2015	Laparoscopic surgery	13
Liao (meta-analysis)[16]	2016	Laparoscopic surgery	17,1
Palanivelu[5]	2017	Laparoscopic surgery	18,9
Poves[15]	2018	Laparoscopic surgery	15
Van Hilst[7]	2019	Laparoscopic surgery	11
Song[4]	2020	Laparoscopic surgery	15
Current study	2023	Laparoscopic surgery	16,6

Conclusion

Standard lymphadenectomy in laparoscopic pancreaticoduodenectomy can meet the requirements for the principles of cancer treatment and having the low rate of complications related to lymph node dissection.

Reference

1. Tomlinson JS, Jain S, Bentrem DJ, et al. Accuracy of staging node-negative pancreas cancer: a potential quality measure. Arch Surg Chic Ill 1960. 2007;142(8):767-723; discussion 773-774. doi:10.1001/archsurg.142.8.767
2. Wang W, Shen Z, Shi Y, et al. Accuracy of Nodal Positivity in Inadequate Lymphadenectomy in Pancreaticoduodenectomy for Pancreatic Ductal Adenocarcinoma: A Population Study Using the US SEER Database. Front Oncol. 2019;9. Accessed July 10, 2022. https://www.frontiersin.org/articles/10.3389/fonc.2019.01386
3. Tol JAMG, Gouma DJ, Bassi C, et al. Definition of a standard lymphadenectomy in surgery for pancreatic ductal adenocarcinoma: a consensus statement by the International Study Group on Pancreatic Surgery (ISGPS). Surgery. 2014;156(3):591-600. doi:10.1016/j.surg.2014.06.016
4. Song KB, Kim SC, Lee W, et al. Laparoscopic pancreaticoduodenectomy for periampullary tumors: lessons learned from 500 consecutive patients in a single center. Surg Endosc. 2020;34(3):1343-1352. doi:10.1007/s00464-019-06913-9
5. Palanivelu C, Senthilnathan P, Sabnis SC, et al. Randomized clinical trial of laparoscopic versus open pancreatoduodenectomy for periampullary tumours. Br J Surg. 2017;104(11):1443-1450. doi:10.1002/bjs.10662
6. Wang M, Zhang H, Wu Z, Zhang Z, Peng B. Laparoscopic pancreaticoduodenectomy: single-surgeon experience. Surg Endosc. 2015;29(12):3783-3794. doi:10.1007/s00464-015-4154-5
7. van Hilst J, de Rooij T, Bosscha K, et al. Laparoscopic versus open pancreatoduodenectomy for pancreatic or periampullary tumours (LEOPARD-2): a multicentre, patient-blinded, randomised controlled phase 2/3 trial. Lancet Gastroenterol Hepatol. 2019;4(3):199-207. doi:10.1016/S2468-1253(19)30004-4
8. Kawarada Y. [New classification of pancreatic carcinoma--Japan Pancreas Society]. Nihon Shokakibyo Gakkai Zasshi Jpn J Gastro-Enterol. 2003;100(8):974-980.

9. Kostov D. Lymphadenectomy in Pancreatic Cancer Surgery.
10. Nimura Y, Nagino M, Takao S, et al. Standard versus extended lymphadenectomy in radical pancreatoduodenectomy for ductal adenocarcinoma of the head of the pancreas: long-term results of a Japanese multicenter randomized controlled trial. J Hepato-Biliary-Pancreat Sci. 2012;19(3):230-241. doi:10.1007/s00534-011-0466-6
11. Michalski CW, Kleeff J, Wente MN, Diener MK, Büchler MW, Friess H. Systematic review and meta-analysis of standard and extended lymphadenectomy in pancreaticoduodenectomy for pancreatic cancer. Br J Surg. 2007;94(3):265-273. doi:10.1002/bjs.5716
12. Henne-Bruns D, Vogel I, Ľttges J, Klưppel G, Kremer B. Surgery for ductal adenocarcinoma of the pancreatic head: staging, complications, and survival after regional versus extended lymphadenectomy. World J Surg. 2000;24(5):595-601; discussion 601-602. doi:10.1007/s002689910089
13. Berger AC, Watson JC, Ross EA, Hoffman JP. The metastatic/examined lymph node ratio is an important prognostic factor after pancreaticoduodenectomy for pancreatic adenocarcinoma. Am Surg. 2004;70(3):235-240; discussion 240.
14. Slidell MB, Chang DC, Cameron JL, et al. Impact of total lymph node count and lymph node ratio on staging and survival after pancreatectomy for pancreatic adenocarcinoma: a large, population-based analysis. Ann Surg Oncol. 2008;15(1):165-174. doi:10.1245/s10434-007-9587-1
15. Riediger H, Keck T, Wellner U, et al. The lymph node ratio is the strongest prognostic factor after resection of pancreatic cancer. J Gastrointest Surg Off J Soc Surg Aliment Tract. 2009;13(7):1337-1344. doi:10.1007/s11605-009-0919-2
16. Liao CH, Wu YT, Liu YY, et al. Systemic Review of the Feasibility and Advantage of Minimally Invasive Pancreaticoduodenectomy. World J Surg. 2016;40(5):1218-1225. doi:10.1007/s00268-016-3433-1