Laparoscopic transhiatal esophagectomy

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Abstract:

This review was conducted to elucidate the current status and approach method and possible beneficial effect of the Lapascopic Transhiatal Esophagectomy. We searched PubMed, and Health Technology Assessment (HTA) databases for recent for studies concerning Lapascopic Transhiatal Esophagectomy. Laparoscopic transhiatal esophagectomy has a number of benefits over open strategies for esophageal cancer resection. Operative mortality and reoperations are equivalent to open techniques, with lower major complication rates, less blood loss and shorter LOS. Laparoscopic transhiatal esophagectomy gives excellent exposure and generates a proper lymph node harvest and oncological resection with equal recurrence and survival rates. Laparoscopic transhiatal esophagectomy needs to be taken into consideration as a preferred approach to esophagectomy.

Introduction:

Esophagectomy is the key element in the curative treatment of patients with esophageal cancer. However, the type of approach and extent of lymphadenectomy that is necessary for esophageal cancer patients remains controversial [34]. Transthoracic esophagectomy (TTE), is advocated because of its extended mediastinal lymph node dissection and improved locoregional control [35]. Others have advocated the transhiatal esophagectomy (THE) for distal esophageal cancer offering

decreased postoperative morbidity with supposedly no compromise in cancer recurrence or survival[36]. Regardless of the type of approach, both procedures still have high complication rates, varying between 40 and 80% [37]. This has encouraged the search for alternative techniques that achieves similar oncological outcomes but with less morbidity and faster recovery times. With this objective in mind, minimally invasive techniques in esophagectomy were introduced for TTE by Cuschieri and coworkers[38] in 1992 and for THE by Depaula and coworkers [39] in 1995. A recent meta-analysis showed that minimally invasive esophagectomy (MIE) reduces overall morbidity and pulmonary complications and could lead to a shorter hospital stay.This was, however, only reported for the transthoracic approach. By avoiding a thoracotomy, it seems obvious that pulmonary complications can be reduced. However, in a laparoscopic approach these benefits are less obvious. To date, no systematic review or meta-analysis has been reported comparing laparoscopic versus open THE.

This review was conducted to elucidate the current status and approach method and possible beneficial effect of the Lapascopic Transhiatal Esophagectomy.

Methodology:

We searched PubMed, and Health Technology Assessment (HTA) databases for recent for studies concerning Lapascopic Transhiatal Esophagectomy published up to December, 2017. Medical Mesh terms were used in our search as following; “Transhiatal Esophagectomy” “laparoscopy” “surgical management”. We applied restriction to our search for only English language articles with human subjects.

Discussion:

Technical Points

The operation has three parts:

Part 1 is the laparoscopic mobilization of the thoracic esophagus via the hiatus.

Part 2 is the laparoscopic stomach part, including mobilization of the entire stomach protecting the epiploic game, stapling of the left gastric artery, including a considerable lymphnode dissection, and the dissection of the respite.

Part 3 is the left cervical access to mobilize the cervical esophagus down right into the thoracic inlet, dissection of the cervical esophagus, and after that drawing down the esophagus into the abdominal area.

Reconstruction is after that executed by creating a slim gastric tube (with mini-laparotomy) and evaluation of perfusion, pull-up of the graft and anastomosis in the neck.

Operation Step by Step

Positioning

Laparoscopic transhiatal esophagectomy is executed with the patient in dorsal lithotomy setting, with the operating surgeon standing in between the legs with aides on either side. The typical precautions for safe positioning are applied. The patient has basic anesthetic with endotracheal intubation, an arterial line for monitoring and either two big IV accesses or a central line (on the

right side of the neck) (Fig. 15.6). Establishing pneumoperitoneum and trocar positioning. The pneumoperitoneum is established either with Veress needle, optiview trocar or Hassan strategy. The location for the very first trocar is similar to the Nissen fundoplication except that it is a straight laceration in the midline, as this laceration will be later included a mini-laparotomy to build the gastric pull-up. The additional trocars are placed in the upper abdomen in a standard laparoscopic Nissen fundoplication arrangement. A diagnostic laparoscopy is done to eliminate any type of peritoneal metastasis, distal illness or liver transition (Fig. 15.7).

Part 1

The distal esophagus and all periesophageal tissue are after that very carefully set in motion and the breakdown is extended proximally in a circumferential way. This allows a very first evaluation of the resectability of the tumor. The operation could be still aborted after initial mobilization, if no risk-free airplane can be experienced to either the aorta, or the pericardium, the airway or the inferior pulmonary capillary. The pericardium is skeletonized anteriorly approximately the carina. In a similar fashion, the aorta is skeletonized posteriorly, and the parietal pleura laterally. The right and left crura are commonly incised to supply far better exposure of the mediastinum (Fig. 15.8).

Part 2

After completing this portion of the mediastinal breakdown, the tummy is then activated preserving the epiploic arcade (Fig. 15.9). This is best started midway by specifying the omentum on top of the transverse colon, after that close to the colon and as much as the inferior border of the spleen the breakdown is performed with a harmonic scalpel. After that, just like the breakdown of the fundus for a laparoscopic fundoplication, however this time instead of close to the belly the breakdown is executed near to the spleen (cave splenic artery). After opening up the pars flaccida

the lower sac is gone into, the left gastric artery identified and a lymphadenectomy of the celiac trunk is performed. The left gastric artery is stapled of with a vascular staple load (white) (Fig. 15.10).

Part 3

The cervical breakdown is then performed via a left neck incision and the cervical esophagus is explored down to the proximal level of the previous mediastinal dissection. The esophagus is then transected in the neck and removed transabdominally after the camera port is expanded with a minilaparotomy to 5 centimeters to suit the sampling. The stomach is after that tubularized by consecutive firings of a GIA 100 mm stapler, and the staple line is over-sewn to prevent lesions of the staple line when being pulled-up, in addition to prevent damage of the staple line to the airway or vascular structures in the chest. The perfusion of the gastric pull-up is then examined with laser-assisted angiography (Spy-System, Novadaq, Toronto), and the area of excellent perfusion noted with a stitch (Fig. 15.11). An upper body tube is after that travelled through the posterior mediastinum, attached to the gastric channel, and delicately withdrawn to pull the conduit up right into the neck (Fig. 15.12). Ample vascular supply of the avenue and the esophagus is validated, and a single-layer disturbed hand-sewn anastomosis is built. In addition, a jejunostomy feeding tube is consistently placed for post-operative dietary supplementation. Pyloroplasty is not carried out for any kind of patients undertaking LTE.

- **The laparoscopic transhiatal approach**

The laparoscopic transhiatal technique was initial defined by DePaula et al. in 1995, with numerous succeeding records concerning this method [1-3].The transhiatal method prevents the complications of directly accessing the thorax. For some specialists this is a regarded lack of

mediastinal exposure that could possibly jeopardize the radial resection margins and lymphadenectomy. Although there was initial concern over the oncological expediency of minimally invasive methods, a systematic review by Dantoc et al. reported greater mean lymph node yield for MIE compared with open techniques (16 vs. 10), in addition to no considerable difference in 5-year survival [4].In our just recently published research we showed that laparoscopic transhiatal esophag -ectomy (LTE) had actually similar outcomes as compared to open esophagectomies, however with the advantages of laparoscopic surgery [5].In recap our research study results: Charts were examined to identify all patients that had actually gone through LTE (33 consecutive patients) for esophageal cancer from a duration of July 2008 to July 2012. Information were assessed and contrasted to a historic cohort of esophageal cancer patients who went through open transhiatal esophagectomy (OTE, 60 patients) and en-bloc esophagectomy (EBE, 139 patients) at the exact same organization from November 2002 to November 2009, to investigate perioperative end results, lymph node harvest, and general survival. Prevalence of comorbidities was substantially greater in the LTE and OTE teams than EBE (p=0.01), with a greater occurrence in all subgroups except occurrence of diabetes. Furthermore, the percentage of patients with positive nodes was comparable amongst all teams (p=0.65), although the number of lymph nodes resected was reduced for the LTE team (22) compared to the OTE and EBE teams (p<0.0001). Reoccurrence was similar amongst all groups (p=0.9), with no significant differences in between the ratios of systemic and locoregional reappearance between the groups (p=0.24). The LTE group had a conversion rate of 6.1% (2/33), with one conversion being due to the inability to plainly determine the left gastric vessels as a result of attachments. The various other conversion was due to difficulty with port positioning and preserving proper insufflation additional to a previous abdominal wall reconstruction. The average operative time was comparable amongst LTE and OTE groups (274 and 275.5 min), and significantly shorter compared to the EBE group (415

min) ($p<0.0001$). The visibility of minor operative complications among the three groups was similar ($p=0.36$), yet significant complications (specified as those needing intervention besides traditional management, a prolonged hospital keep, or any anastomotic complication) were significantly much less typical in the LTE group ($p=0.04$). The average LOS was dramatically reduced for the LTE team at 10 days, compared to the OTE and EBE teams, at 13 days and 15 days, respectively ($p<0.0001$).

Median follow-up was 26 months (2-55 months) for the LTE team. Making use of the Kaplan-Meier approach, overall survival was not significantly different in between the groups, with an average survival at 24 months of 70%, 65%, and 65% specifically ($p=0.65$). The variety of facilities using MIE remains to increase, along with the total percentage of patients undergoing MIE as compared to open repair [6].As a result of the problem of randomization, just one test has been published to date. This study compared open transthoracic with minimally invasive transthoracic esophagectomy, showing lower rates of pulmonary problems and shorter hospital remain in the MIE team, with equivalent lymph node yield in between the two arms [7].In their picked series of LTE as compared to laparoscopic and thoracoscopic two-field esophagectomy, Benzoni et al. revealed shorter operative times, shorter ICU and general remain, and a trend towards far better survival in the LTE group [8]; although this was restricted by a little number of patients.

- **Conversion Rate and Learning Curve**

Relying on the sort of MIE utilized, conversion rates have been reported in between 3% and 18% in the literature [3,5,9-12].Although previous reports described problems with bleeding due to blunt dissection connected with the transhiatal approach, we experienced no such concerns with hemostasis, as our conversions were due to aberrant anatomical considerations. Luketich et al. reported conversion rate of 4.5% in their large series, with reasons for conversion from laparoscopy

most commonly cited as adhesions, inadequate conduit length, tumor thickness, or require to better evaluate margins [13].Several of the collection report very early conversions as component of the knowing curve.

- **The Benefits of Laparoscopic Surgery**

In the study the LTE group showed a considerably shorter operative time than the EBE group, and operative times approach those reported in various other recent collection of laparoscopic and laparoscopic hand-assisted transhiatal esophagectomies [1,11,14,15]. Maas et al. revealed similar operative times when contrasting LTE and OTE (300 min vs. 280 min, p=0.11). LTE also has the possibility for shorter operative times as compared to other MIE methods using thoracoscopy given that these require intraoperative repositioning of the patient. Additionally, with enhanced visualization during a laparoscopic transhiatal strategy, blood loss is lessened as there is much less "blind" dissection associated with the open transhiatal approach.

The significantly shorter length of remain in our research for LTE follows various other reports of MIE [1,16].Bernabe showed a shorter LOS for hand aided LTE as compared to OTE (9.1 vs. 11.6, p=0.037) [17] with a similar reduction revealed by Scheepers et al. [18] and Maas [19] In their review, Decker et al. reported median LOS of 11.5 days for all MIE techniques, versus 15-19 days for conventional [19].The LTE strategy likewise causes much less tissue trauma than traditional open techniques and three-field MIE methods. Parameswaran et al. displayed in their possible longitudinal study that patients undergoing MIE began to recover within 3 months and return to baseline by 6 months, which was maintained at 1 year [20].The transhiatal approach can possibly reduce complications by staying clear of the atelectasis related to thoracoscopy or thoracotomy. Although minor post-operative problems were similar amongst groups, significant operative difficulties were significantly lower in the laparoscopic group. Hulscher et al. showed lower rates

of pulmonary problems with the transhiatal method in a randomized trial, most likely by preventing the need for solitary lung ventilation and direct thoracic gain access to [21].Various other research studies have reported lower rates of chest problems with MIE [20,22,23].Maas et al. likewise showed a lower occurrence, although not considerable, of pulmonary and cardiac complications in their comparison of LTE and OTE [11].Various other relative research studies have shown 8-- 10% difficulty rates for open and 7-8% for LTE [24,25].

Shiozaki et al. report that performing the lower and middle portions of the mediastinal lymphadenectomy via the hiatus enables it to be approached along the proper physiological layers, with excellent surgical sights of the back and left mediastinum [28] Organization formerly reported a survival advantage for patients with 23 or even more LN resected [29], although it is vague whether this benefit is because of stage movement or obliteration of occult metastatic condition. Recent studies have recommended that a less invasive and less radical procedure is not necessarily a less alleviative one. In a randomized test by Hulscher et al., there was no considerable distinction in the average survival, disease-free survival, and quality-adjusted survival between the groups [30].The authors commented that long follow-up is should establish whether the feasible survival advantage surpasses the boosted morbidity associated with the transthoracic approach. Reports from our institution have shown better survival and decreased local reoccurrence with even more radical LN resections in chosen collection [31,32].Recent reports comparing MIE to open strategies have shown a minimum of equivalent survival. Dantoc et al. also reported no distinction in total 5-year survival in between open and MIE, and although MIE revealed far better survival in earlier period, this was not substantiated when evaluated for phase [33].Maas et al. showed no distinction in overall and disease-free survival at 3 and 5 years in their research study comparing LTE and OTE [11].Others have recommended that survival may be improved with MIE. Montenovo et al.

reported improved 5-year survival (63% vs. 50%) for laparoscopic-assisted THE as compared to EBE [1], although there is no comparative information to confirm this. Most of current publications and our own experience recommend MIE generally and LTE particularly contends least equal survival compared with open methods.

Conclusion:

Laparoscopic transhiatal esophagectomy has a number of benefits over open strategies for esophageal cancer resection. Operative mortality and reoperations are equivalent to open techniques, with lower major complication rates, less blood loss and shorter LOS. Laparoscopic transhiatal esophagectomy gives excellent exposure and generates a proper lymph node harvest and oncological resection with equal recurrence and survival rates. Laparoscopic transhiatal esophagectomy needs to be taken into consideration as a preferred approach to esophagectomy.

Reference:

1. Montenovo MI, Chambers K, Pellegrini CA, Oelschlager BK. Outcomes of laparoscopic-assisted transhiatalesophagectomy for adenocarcinoma of the esophagus and esophagogastric junction. Dis Esophagus. 2011;24:430–6.
2. DePaula AL, Hashiba K, Ferreira EA, de Paula RA, Grecco E. Laparoscopic transhiatalesophagectomy with esophagogastroplasty. Surg Laparosc Endosc. 1995;5:1–5.

3. Bonavina L, Incarbone R, Bona D, Peracchia A. Esophagectomy via laparoscopy and transmediastinalendodissection. J Laparoendosc Adv Surg Tech A. 2004;14:13–6.
4. Dantoc MM, Cox MR, Eslick GD. Does minimally invasive esophagectomy (MIE) provide for comparable oncologic outcomes to open techniques? A systematic review. J Gastrointest Surg. 2012;16:486–94.
5. Cash JC, Zehetner J, Hedayati B, Bildzukewics NA, Katkhouda N, Mason RJ, Lipham JC. Outcomes following laparoscopic transhiatalesophagectomy for esophageal cancer. Surg Endosc. 2014;28: 492–9.
6. Lazzarino AI, Nagpal K, Bottle A, Faiz O, Moorthy K, Aylin P. Open versus minimally invasive esophagectomy: trends of utilization and associated outcomes in England. Ann Surg. 2010;252:292–8.
7. Biere SS, van Berge Henegouwen MI, Maas KW, Bonavina L, Rosman C, Garcia JR, Gisbertz SS, Klinkenbijl JH, Hollmann MW, de Lange ES, Bonjer HJ, van der Peet DL, Cuesta MA. Minimally invasive versus open oesophagectomy for patients with oesophageal cancer: a multicentre, open-label, randomised controlled trial. Lancet. 2012;379:1887–92.
8. Benzoni E, Terrosu G, Bresadola V, Uzzau A, Intini S, Noce L, Cedolini C, Bresadola F, De Anna D. A comparative study of the transhiatal laparoscopic approach versus laparoscopic gastricmobilisation and right open transthoracic esophagectomy for esophageal cancer management. J Gastrointest Liver Dis. 2007;16:395–401.
9. Nguyen NT, Hinojosa MW, Smith BR, Chang KJ, Gray J, Hoyt D. Minimally invasive esophagectomy: lessons learned from 104 operations. Ann Surg. 2008;248:1081–91.
10. Song SY, Na KJ, Oh SG, Ahn BH. Learning curves of minimally invasive esophageal cancer surgery. Eur J Cardiothorac Surg. 2009;35:689–93.
11. Maas KW, Biere SS, Scheepers JJ, Gisbertz SS, Van-der-Peet DL, Cuesta MA. Laparoscopic versus open transhiatalesophagectomy for distal and junction cancer. Rev Esp Enferm Dig. 2012;104: 197–202.
12. Santin BJ, Price P. Laparoscopic transhiatalesophagectomy at a low-volume center. JSLS. 2011;15:41–6.
13. Luketich JD, Pennathur A, Awais O, Levy RM, Keeley S, Shende M, Christie NA, Weksler B, Landreneau RJ, Abbas G, Schuchert MJ, Nason KS. Outcomes after minimally invasive esophagectomy: review of over 1000 patients. Ann Surg. 2012;256:95–103.
14. Parker M, Bowers SP, Goldberg RF, Pfluke JM, Stauffer JA, Asbun HJ, Smith CD. Transcervicalvideoscopic esophageal dissection during two-field minimally invasive esophagectomy: early patient experience. Surg Endosc. 2011;25:3865–9.
15. Aujesky R, Neoral C, Kral V, Bohanes T, Vrba R, Vomackova K. Video-assisted laparoscopic resection of the esophagus for carcinoma after neoadjuvant therapy. Hepatogastroenterology. 2009;56:1035–8.
16. Ben-David K, Sarosi GA, Cendan JC, Howard D, Rossidis G, Hochwald SN. Decreasing morbidity and mortality in 100 consecutive minimally invasive esophagectomies. Surg Endosc. 2012;26: 162–7.

17. Bernabe KQ, Bolton JS, Richardson WS. Laparoscopic handassisted versus open transhiatalesophagectomy: a casecontrol study. Surg Endosc. 2005;19:334–7.
18. Scheepers JJ, Veenhof AA, van der Peet DL, van Groeningen C, Mulder C, Meijer S, Cuesta MA. Laparoscopic transhiatal resection for malignancies of the distal esophagus: outcome of the first 50 resected patients. Surgery. 2008;143:278–285 498. SurgEndosc. 2014;28:492–499 123.
19. Decker G, Coosemans W, De Leyn P, Decaluwe H, Nafteux P, Van Raemdonck D, Lerut T. Minimally invasive esophagectomy for cancer. Eur J Cardiothorac Surg. 2009;35:13—20. discussion 20–11.
20. Parameswaran R, Blazeby JM, Hughes R, Mitchell K, Berrisford RG, Wajed SA. Health-related quality of life after minimally invasiveoesophagectomy. Br J Surg. 2010;97:525–31.
21. Hulscher JB, van Sandick JW, de Boer AG, Wijnhoven BP, Tijssen JG, Fockens P, Stalmeier PF, ten Kate FJ, van Dekken H, Obertop H, Tilanus HW, van Lanschot JJ. Extended transthoracic resection compared with limited transhiatal resection for adenocarcinoma of the esophagus. N Engl J Med. 2002;347:1662–9.
22. Lee JM, Cheng JW, Lin MT, Huang PM, Chen JS, Lee YC. Is there any benefit to incorporating a laparoscopic procedure into minimally invasive esophagectomy? The impact on perioperative results in patients with esophageal cancer. World J Surg. 2011;35: 790–7.
23. Schoppmann SF, Prager G, Langer FB, Riegler FM, Kabon B, Fleischmann E, Zacherl J. Open versus minimally invasive esophagectomy: a single-center case controlled study. Surg Endosc. 2010;24:3044–53.
24. Van den Broek WT, Makay O, Berends FJ, Yuan JZ, Houdijk AP, Meijer S, Cuesta MA. Laparoscopically assisted transhiatal resection for malignancies of the distal esophagus. Surg Endosc. 2004;18:812–7.
25. Dapri G, Himpens J, Cadiere GB. Minimally invasive esophagectomy for cancer: laparoscopic transhiatal procedure or thoracoscopy in prone position followed by laparoscopy? Surg Endosc. 2008;22:1060–9.
26. Urschel JD. Esophagogastrostomy anastomotic leaks complicatingesophagectomy: a review. Am J Surg. 1995;169:634–40.
27. Orringer MB, Marshall B, Chang AC, Lee J, Pickens A, Lau CL. Two thousand transhiatalesophagectomies: changing trends, lessons learned. Ann Surg. 2007;246:363–72. discussion 372–364.
28. Shiozaki A, Fujiwara H, Murayama Y, Komatsu S, Kuriu Y, Ikoma H, Nakanishi M, Ichikawa D, Okamoto K, Ochiai T, Kokuba Y, Otsuji E. Perioperative outcomes of esophagectomy preceded by the laparoscopic transhiatal approach for esophageal cancer. Dis Esophagus. 2012. doi:10.1111/j.1442-2050.2012.01439.
29. Peyre CG, Hagen JA, DeMeester SR, Altorki NK, Ancona E, Griffin SM, Holscher A, Lerut T, Law S, Rice TW, Ruol A, van Lanschot JJ, Wong J, DeMeester TR. The number of

lymph nodes removed predicts survival in esophageal cancer: an international study on the impact of extent of surgical resection. Ann Surg. 2008;248:549–56.

30. Hulscher JB, Van Sandick JW, Offerhaus GJ, Tilanus HW, Obertop H, Van Lanschot JJ. Prospective analysis of the diagnostic yield of extended en bloc resection for adenocarcinoma of the oesophagus or gastric cardia. Br J Surg. 2001;88:715–9.
31. Hagen JA, DeMeester SR, Peters JH, Chandrasoma P, DeMeester TR. Curative resection for esophageal adenocarcinoma: analysisof 100 en bloc esophagectomies. Ann Surg. 2001;234:520–30. discussion 530–52154.
32. Johansson J, DeMeester TR, Hagen JA, DeMeester SR, Peters JH, Oberg S, Bremner CG. En bloc vstranshiatalesophagectomy for stage T3 N1 adenocarcinoma of the distal esophagus. Arch Surg. 2004;139:627–31. discussion 631–623.
33. Dantoc M, Cox MR, Eslick GD. Evidence to support the use of minimally invasive esophagectomy for esophageal cancer: a metaanalysis. Arch Surg. 2012;147:768–76.
34. Barreto J C, Posner M C. Transhiatal versus transthoracic esophagectomy for esophageal cancer. World J Gastroenterol 2010 (Aug 14); 16 (30): 3804–10.
35. Lewis I. The surgical treatment of carcinoma of the oesophagus; with special reference to a new operation for growths of the middle third. Br J Surg 1946 (Jul); 34: 18–31.
36. Orringer M B, Marshall B, Chang A C, Lee J, Pickens A, Lau C L. Two thousand transhiatal esophagectomies: changing trends, lessons learned. Ann Surg 2007 (Sep); 246 (3): 363–72.
37. Boshier P R, Anderson O, Hanna G B. Transthoracic versus transhiatal esophagectomy for the treatment of esophagogastric cancer: A meta-analysis. Ann Surg 2011 (Dec); 254 (6): 894–906.
38. Cuschieri A, Shimi S, Banting S. Endoscopic oesophagectomy through a right thoracoscopic approach. J R Coll Surg Edinb 1992 (Feb); 37 (1): 7–11.
39. DePaula A L, Hashiba K, Ferreira E A, de Paula R A, Grecco E. Laparoscopic transhiatal esophagectomy with esophagogastroplasty. Surg Laparosc Endosc 1995 (Feb); 5 (1): 1–5.