

Standardizing D2 Lymphadenectomy in Gastric Cancer Using Checklist: A Retrospective Analysis of Prospective Cohort

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Abstract

Background: R0 surgical resection with D2 lymphadenectomy has been the cornerstone treatment in major gastric cancer guidelines for resectable locally advanced gastric cancer. The extent of D2 lymphadenectomy may vary among surgeons because of technical difficulty and lack of anatomical definition of individual lymph node (LN) stations.

Objective: To standardize our surgical quality of D2 lymphadenectomy and improve surgical proficiency using checklist method.

Method: In this retrospective analysis of a prospective cohort, all consecutive resectable gastric cancer patients who underwent curative gastrectomy with D2 lymphadenectomy in Kathmandu medical college and teaching hospital (KMCTH) were analyzed. A complete unedited video of our surgical procedure was recorded and evaluation was done for completeness of D2 lymphadenectomy. Surgical compliance (removal of indicated lymph node stations) and surgicopathological compliance (removal of > 15 lymph nodes) were recorded and assessed.

Results: Out of 56 resectable gastrectomy patients, 41 (73.2%) were male and the mean age was 62 years. Average duration of surgery was 222 mins and mean hospital stay was 7 days. Surgical compliance occurred in 51 (91.1%) with 100% surgicopathological compliance. Median lymph node (LN) retrieved was 24.

Conclusion: Surgical quality can be standardized using checklist in D2 lymphadenectomy for gastric cancers.

Keywords: Gastric Cancer; D2 Lymphadenectomy; Standardization

Introduction

Gastric cancer is the fourth most common cancer and accounts for 10% of cancer related death worldwide [1]. Complete resection of primary tumor with D2 lymphadenectomy has been the cornerstone in the treatment for resectable gastric cancer [2]. However, extent of LN dissection during gastrectomy has been a debated issue in the Asian and western world [3].

Lymphadenectomy is an uncontroversial and accepted process in disease staging and remains one of the crucial independent predicting factors for survival after gastric cancer surgery [4]. Major guidelines for gastric cancer recommend gastrectomy with D2 lymphadenectomy for the treatment of resectable gastric cancer and have shown superior patient survival than D1 lymphadenectomy [5-8]. They have hypothesized that adequate nodal clearance facilitates accurate disease staging, reduces loco regional recurrences and improves disease specific and overall survival of the patient.

Tumor location defines the extent of resection as total, subtotal and distal gastrectomy and the lymphatic clearance as D1, D2 and D3. In addition to above, different subclasses have been suggested such as for distal gastrectomy, D1 lymphadenectomy involves removing station 1, 3, 4sb, 4d, 5, 6, 7 nodes, D1+ involves D1 plus station 8a and 9 nodes, D2 lymphadenectomy involves removing D1 plus 8a, 9, 11p, 12a nodes. For total gastrectomy, D1 involves removal of station 1-7 LN, D1+ involves D1 plus 8a, 9, 11p nodes and D2 involves removal of D1 plus, 8a, 9, 11p, 11d, 12a nodes [9]. This individual station LN clearance may vary amongst surgeons. This could be secondary to technical difficulty and lack of anatomical definition of individual LN stations [5].

Aim of the Study

So, in this study, we have tried to comply with the stepwise checklist protocol for D2 nodal clearance and standardize a homogeneous surgical approach for better quality assurance.

Methodology

Study design: The study cohort was a part of database created for all gastric cancer patients who underwent curative gastrectomy with D2 lymphadenectomy from July 2015 to Jan 2020 in department of surgery, Kathmandu medical college and teaching hospital (KMCTH). Ethical approval was taken from the Institutional Review Committee of KMCTH and informed consent taken from the patients.

A D2 lymphadenectomy step wise checklist was prepared as per the KLASS -02-QC trial [10]. All surgeries were performed by experienced senior consultants of one surgical unit. Video recording of major surgeries is a routine practice of our surgical unit for future reference and demonstration. A complete unedited video was evaluated by surgeon of another unit and cross-checked using checklist for validation of D2 lymphadenectomy. Each step was marked and recorded for completion. After completing the resection, reconstruction was done in Billroth-I, Billroth-II or Roux en Y method. Hand sewn or staplers were used for anastomosis. Patients demographic characteristics, postoperative morbidity, hospital stay, surgical compliance and surgicopathological compliance were recorded. Postoperative care, pain management, diet schedule were managed as per our unit protocol. Patients with stage II and stage III disease were referred to oncologist for adjuvant therapy 4 - 6 weeks after surgery.

Study objectives: To standardize our surgical quality of D2 lymphadenectomy and improve surgical proficiency using checklist method.

Eligibility criteria

All locally advanced gastric cancer patients (invasion to muscularis propria and not into an adjacent organ cT2-cT4a) who underwent resection with curative intent were included. Patients with metastasis, previous gastric surgery, unwilling to participate in the study were excluded.

Data assessment

Surgical compliance: Surgical compliance was defined as removal of indicated lymph node stations as per the checklist for D2 lymphadenectomy. Surgical lymph node stations were defined as per the Japanese gastric cancer treatment guidelines [9].

Surgicopathological compliance: Surgicopathological compliance was defined as removal of more than 15 lymph nodes and noncompliance was defined as removal of less than 15 nodes.

Intraoperative pictures (Figure 1-3) demonstrating LN stations and bursectomy.

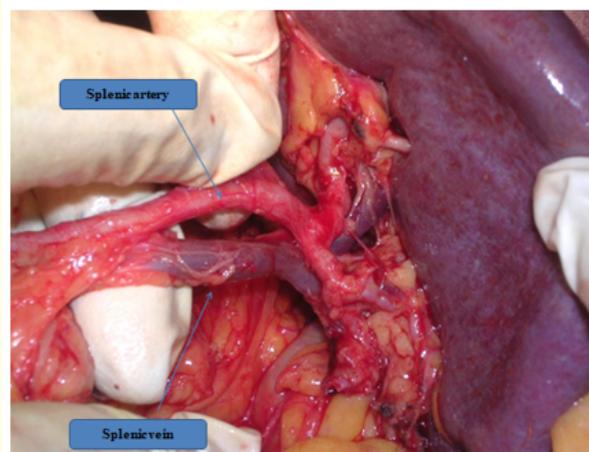


Figure 1: Lymphatic clearance along station 10.

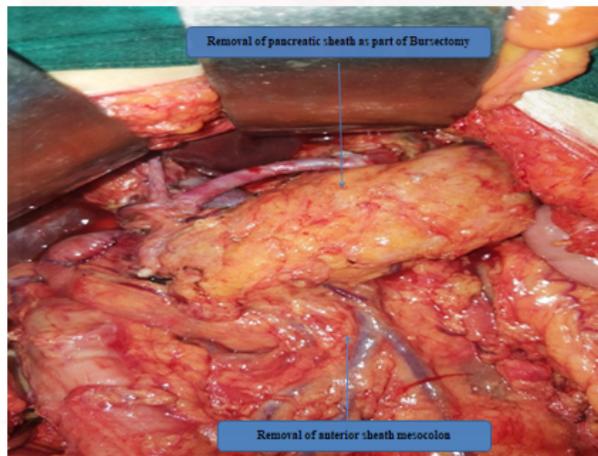


Figure 2: Bursectomy.

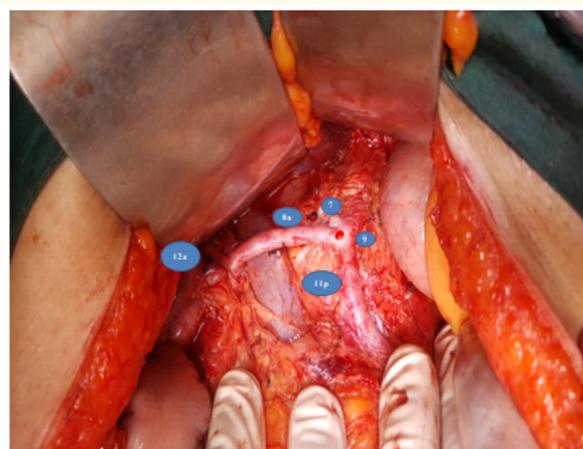


Figure 3: Lymphatic clearance along the celiac trunk.

Results

A total of 56 patients with resectable gastric cancer underwent open R0 resection with D2 lymphadenectomy from July 2015 to January 2020. Mean age of the patients was 62 years and predominantly male 41 (73.2%). Median number of LN retrieved was 24 (range 16 - 32).

Table 1 shows demographic characteristics of patients.

Table 1: Patient demographics characters

Mean age (Years)	62.34 (range 39-80)
Sex	
Male	41 (73.2%)
Female	15 (26.8%)
Location of tumor	
Proximal 1/3	11 (19.6%)
Middle 1/3	14 (25%)
Distal 1/3	31 (55.4%)
Type of gastric resection	
Total	11 (19.6%)
Sub-total	45 (80.4%)

The location of primary tumor in proximal 1/3, middle 1/3 and distal 1/3 was 11 (19.6%), 14 (25%) and 31 (55.4%) respectively. Majority of our patients underwent R0 subtotal gastrectomy with D2 lymphadenectomy and Billroth II reconstruction using GIA staplers or handsewn method. Surgical compliance and surgicopathological compliance was achieved in 51 (91.1%) and 100% respectively. Mean operating time was 222.61 (± 24.02) minutes and mean hospital stay was 7.18 (± 1.081) days. Majority of the patients had adenocarcinoma 48 (85.7%), pT3 stage 34 (60.7%) and lympho-vascular invasion seen in 45 (80.4%).

Pathological staging	
pT0/Tis/pT 1	0
pT2	12 (21.4%)
pT3	34 (60.7%)
pT4	10 (17.9%)
Tumor histology	
Adenocarcinoma	48 (85.7%)
Signet ring type	08 (14.3%)
Surgical compliance	51 (91.1%)
Surgicopathological compliance	56 (100%)
Lymph node (median)	24 (range 16 - 32)
Lymph vascular and perineural invasion	
Invasion present	45 (80.4%)
Invasion absent	11 (19.6%)

Table 2: Showing histopathological staging.

The location of primary tumor in proximal 1/3, middle 1/3 and distal 1/3 was 11 (19.6%), 14 (25%) and 31 (55.4%) respectively. Majority of our patients underwent R0 subtotal gastrectomy with D2 lymphadenectomy and Billroth II reconstruction using GIA staplers or handsewn method. Surgical compliance and surgicopathological compliance was achieved in 51 (91.1%) and 100% respectively. Mean operating time was 222.61 (\pm 24.02) minutes and mean hospital stay was 7.18 (\pm 1.081) days. Majority of the patients had adenocarcinoma 48 (85.7%), pT3 stage 34 (60.7%) and lympho-vascular invasion seen in 45 (80.4%).

Discussion

In this prospective consecutive series, we have tried a homogeneous approach to our D2 lymphadenectomy method by evaluating the unedited video and confirming each step to standardize our practice as per the high-volume centers abroad.

Curative (R0) resection with D2 LN dissection has been accepted as a standard practice for gastric cancer in Eastern countries since 1960 and recently these practice has been incorporated into western guidelines [6]. Many studies have demonstrated good survival and low perioperative morbidity and mortality after this extensive LN dissection [11,12]. However, some European RCT has demonstrated no long term survival benefit and increased perioperative morbidity and mortality with D2 lymphadenectomy [13,14]. In contrary to the previous findings, recent meta-analysis has shown improved survival of T3/T4 patients with preservation of pancreas and spleen [15].

Theoretically, inadequate LN retrieved during the primary surgery increases the risk of microscopic and macroscopic residual tumor cells hence higher rate of disease recurrence and poor prognosis [16]. Radical surgery with adequately dissected and harvested lymph node improves pathological staging. Therefore, it complements loco regional tumor control and improves oncological outcomes after gastric cancer surgery [17].

According to the 8th edition of TNM classification, nodal status is an important factor in gastric cancer staging and lymph node above 16 has been proposed for accurate pN stage [18]. Songun., *et al.* [19] have showed that in 15 years follow-up study, local recurrence rate for patients undergoing D2 lymphadenectomy were significantly lower than that of patients undergoing D1 clearance. This indicates extending LN dissection had survival benefits. In a RCT by Degiuli., *et al.* [14], D2 lymphadenectomy did not improve 5-years survival rate in T1 gastric cancers. However, patients with T2-T4 gastric cancers, 5-years survival rate was higher than in the D1 group (59% vs 8%). In our study, majority (60.7%) of patients were operated in T3 stage. This could be due to the lack nationwide screening programs which otherwise could aid in early identification of gastric cancer patients.

Incomplete LN assessment may be related to surgeon performing inadequate dissection or pathologist doing insufficient lymph node assessment. For surgeons, dissection of LN located at different stations in and around the major retroperitoneal vessels and adjacent organs which needs to be preserved might be challenging. Hence, surgeons are considered as an independent non-TNM prognostic factor in gastric cancer surgery for achieving adequate lymph node samples [20]. If the resected specimen remains of uniformly standard quality, the results will be helpful to identify differences in surgical outcomes using different treatment methods like open, laparoscopic or robotic surgery [10].

At times unwanted injuries to adjacent organ or bleeding can be encountered during the procedure which can be observed in the unedited video and can be corrected or avoided in subsequent procedures. So, to develop a harmony in D2 nodal dissection for gastric cancer surgery, step wise assessment using checklist maybe beneficial in evaluating for completeness of D2 lymphadenectomy. In our study, incomplete surgical compliance 5 (8.9%) which was seen in the early phase improved to 91.1% with time after repeatedly watching the unedited videos and correcting the surgical steps as per the checklist. We believe this method of standardizing D2 lymphadenectomy for gastric cancers can be repeated in all centers to provide new information on the surgical aspect and educate fellow surgeons to improve the surgical outcomes.

Conclusion

Finally, standardization of D2 lymphadenectomy may be possible using checklist to achieve a homogenous resection specimen and improve surgical proficiency. In addition to that, standardizing these procedures will help educating other fellow surgeons to this step wise learning approach.

Checklist Questionnaire

D2 checklist questionnaire.

Surgical Video Assessment Form				
Patient ID:		Video ID:		
Procedure	Station	Requirement	Meets the requirement	In case of "No" please identify the reason
1. Total omentectomy		No injury was made to the any other organ.	Yes / No	
2. Division of left gastroepiploic artery (It is not necessary to dissect the root of left gastroepiploic artery if the tumor is located in lower third of the stomach.)	4Sb	The left gastroepiploic artery and left gastroepiploic vein are divided at least below the bifurcation of the first gastric branch.	Yes / No	
		No injury was made to the colon of splenic flexure.	Yes / No	
	4d	The branch of right gastroepiploic artery and vein are retrieved.	Yes / No	
3. Appropriate extent of No. 6 lymph node (LN) dissection	6	The right gastroepiploic vein is divided just above the bifurcation of the anterior superior pancreaticoduodenal vein and the right gastroepiploic vein.	Yes / No	
		The right gastroepiploic artery is divided just peripheral to the bifurcation of the right gastroepiploic artery and the anterior superior pancreaticoduodenal artery.	Yes / No	
		The lowest anterior superior pancreaticoduodenal vein is identified and exposed.	Yes / No	
		The prepancreatic soft tissues above the lowest anterior superior pancreaticoduodenal vein are completely removed.	Yes / No	
		The prepancreatic soft tissues above the level of the bifurcation of the anterior superior pancreaticoduodenal vein and right gastroepiploic vein are completely removed.	Yes / No	
		No injury was made to the pancreatic parenchyma.	Yes / No	
4. Appropriate extent of No. 5 LN dissection	5	The root of right gastric artery is identified and exposed.	Yes / No	
5. Appropriate extent of No. 12a LN dissection	12a	The lower half of the proper hepatic artery is exposed; at least its anterior and left surfaces.	Yes / No	
		The left side of the portal vein is identified and exposed and soft tissues are completely removed.	Yes / No	
6. Appropriate extent of No. 8a	8a	The common hepatic artery is exposed; at least its anterior and superior surfaces.	Yes / No	
		The soft tissues above the upper edge of the pancreas are completely removed.	Yes / No	
7. Appropriate extent of No. 9 LN dissection (resection of the celiac plexus is not necessary)	9	The retroperitoneal membrane is divided along the boundary between the right crus and the soft tissues around the celiac trunk to completely dissect No. 9 LNs.	Yes / No	
8. Appropriate extent of No. 7 LN dissection	7	The root of the left gastric artery is exposed and ligated.	Yes / No	
9. Appropriate extent of No. 11p LN dissection	11p	The proximal half of the splenic artery is exposed, from its root to the site where the meandering splenic artery is in the closest vicinity to the stomach.	Yes / No	
		The splenic vein is identified and exposed, or at least the dorsal side of pancreatic parenchyma is exposed.	Yes / No	
10. Prevention of pancreatic injury during suprapancreatic LN dissection		No pancreatic injury by heat of energy devices and/or assistant's forceps was caused.	Yes / No	
11. Appropriate extent of No. 1 and 3 LN dissection	1, 3	The soft tissue attached to the lesser curvature side of gastric wall is completely removed.	Yes / No	
		No esophageal and/or gastric injury by heat of energy devices and/or blind manipulation was caused.	Yes / No	

Table: Evaluation criteria for completeness of subtotal D2 lymphadenectomy.

Conflict of Interest

None.

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