CRITICAL VIEW OF QUALITY: A NOVEL TOOL FOR AI-BASED ASSESSMENT OF LYMPH NODE DISSECTION QUALITY IN DISTAL GASTRECTOMY

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INTRODUCTION

- **Artificial intelligence (AI)** models have demonstrated potential for improving **surgical video analysis**, yet an objective metric for quality assessment of safe and complete surgery remains lacking.
- This study introduces the **Critical View of "Quality" (CVQ)**, a novel metric for measuring the **quality of lymph node (LN) dissection** in minimally-invasive **distal gastrectomy (DG)** using visual cues observable in surgical videos.
- The ultimate goal is to create a foundation for integrating this tool into an AI model capable of **evaluating surgical performance**.

METHODS AND PROCEDURES

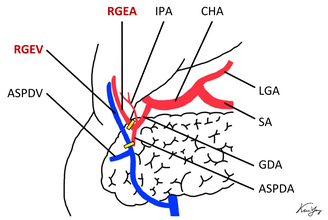
- This retrospective video-based study included 200 patients who underwent DG with adequate lymphadenectomy for **primary gastric cancer** at a high-volume center between November 2020 and July 2023.
- We developed the CVQ scale to assess the **quality of surgical radicality** based on key anatomical structures in five major LN stations.

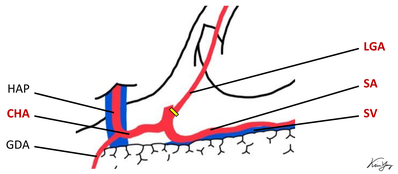
Score	B. LN#6 dissection (score range: 0-4)	
0	The **RGEV root** is not identified before ligation.	The **RGEA root** is not identified before ligation.
1	The **RGEV root** is identified but not isolated before ligation.	The **RGEA root** is identified but not isolated before ligation.
2	The **RGEV root** is identified and clearly isolated before ligation.	The **RGEA root** is identified and clearly isolated before ligation.

* RGEV: right gastroepiploic vein, RGEA: right gastroepiploic artery

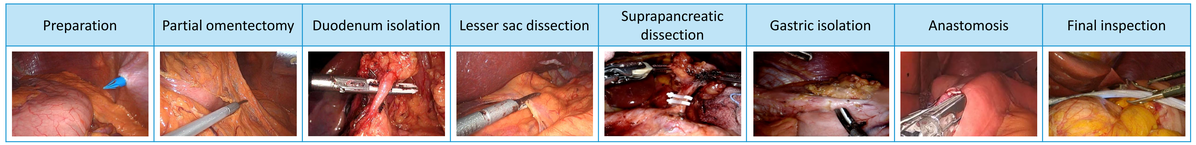
Score	0	1	2
D. Suprapancreatic LN dissection (score range: 0-8)	The **CHA** is not identified.	The **CHA** is identified but only partially exposed.	The **CHA** is identified and completely exposed.
	The **LGA root** is not identified before ligation.	The **LGA root** is identified but not isolated before ligation.	The **LGA root** is identified and clearly isolated before ligation.
	The **SA** is not identified.	The **SA** is identified but only partially exposed.	The **SA** is identified and completely exposed.
	The **SV** is not identified.	The **SV** is identified but only partially exposed.	The **SV** is identified and completely exposed.

* CHA: common hepatic artery, LGA: left gastric artery, SA: splenic artery, SV: splenic vein



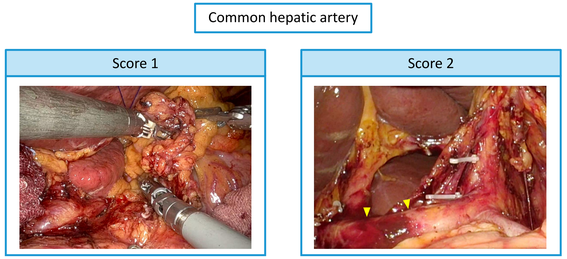


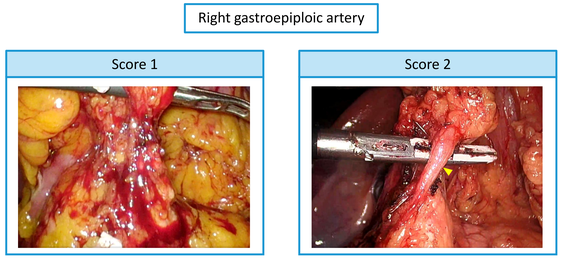
- The correlation between **CVQ scores and number of retrieved LNs** was evaluated.
- To assess the feasibility of basing an AI model on the CVQ system, we examined **inter-rater agreement** among three raters for 33 videos. A surgical intelligence platform (Theator, Inc.) that segments DG videos was used for analysis.



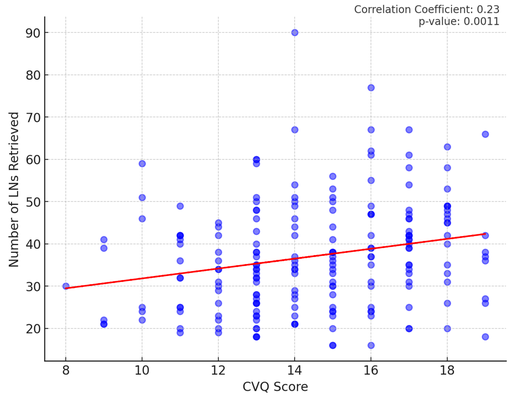
RESULTS

- CVQ scores ranged from 9 to 19, with a mean total score of 14.5 ± 2.5. The highest CVQ scores were observed for key structures in the suprapancreatic LN and LN#6 stations, where perfect scores were achieved in 93.8% and 77.8% of cases, respectively.





- **The CVQ score was positively correlated with LN yield** (r=0.23, p=0.0011).



- Inter-rater agreement was strongest for LN#6, with an agreement of 97% for RGEA (K=0.892, p<0.001).

LN stations	2 raters			3 raters		
	Agreement (%)	K coeff	p-value	Agreement (%)	K coeff	p-value
A. LN#4sb						
LGEV/A	83	0.699	<0.001	64	0.643	<0.001
B. LN#6						
RGEV	73	0.403	0.009	80	0.678	<0.001
RGEA	87	0.442	0.003	97	0.892	<0.001
C. LN#5/12a						
RGA	87	0.736	<0.001	80	0.730	<0.001
HPA	93	0.881	<0.001	47	0.369	<0.001
D. Suprapancreatic LN						
CHA	93	0.571	<0.001	67	0.225	0.013
LGA	100	1.000	0.004	80	0.730	<0.001
SA	90	0.804	<0.001	37	0.298	<0.001
E. LN#1/3a						
Esophagus	97	0.933	<0.001	63	0.491	<0.001

CONCLUSIONS

- **The novel CVQ tool is a sensitive and objective measure of LN dissection quality in DG.** The significant correlation between CVQ scores and number of retrieved LNs highlights the potential clinical utility of CVQ for evaluating the completeness of oncologic resection.
- **High inter-rater agreement suggests that the chosen visual cues will enable accurate AI-based scoring.** By forming a solid basis for integrating the CVQ system into an AI model, we aim to establish a reliable standard for assessing surgical quality.