Methodology for Developing an Educational and Research Video Library in Minimally Invasive Surgery

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OBJECTIVE: Explore the methods used and costs necessary for the creation and maintenance of a surgical video library with an emphasis on its applications in surgical education and scholarship.

DESIGN: A methodology paper highlighting how to develop and utilize a surgical video library for trainee operative preparation, development of research projects, and surgeon credentialing.

SETTING: The study was conducted at the University of Pittsburgh Medical Center, a tertiary care medical center.

PARTICIPANTS: Not applicable.

RESULTS: The video library includes all recorded robotic operations performed by the Division of Surgical Oncology at the University of Pittsburgh from 2010 to 2018. It includes 929 videos of which 110 selected videos are uploaded for trainee review online to prepare for upcoming operations. These procedures are broken into steps to create intraoperative time metrics for trainee integration. Fellows operated from console in 85% of robotic cases and all 30 fellows could obtain robotic privileges based on case logs. To date 102 short scholarly videos have been created: 7 for manuscripts, 13 as video submissions, 27 in book chapters, and 55 for presentations. Three papers have been published using video review to determine clinical outcomes with four more under evaluation. The cost of the program is <$10,000 annually.

CONCLUSIONS: Video libraries can be efficiently created utilizing intraoperative recorders for minimally invasive surgery. Breaking surgeries into distinct steps can aid in deliberate integration and answer clinical questions. Overall video libraries are cost effective tools for trainee education, research, and ultimately surgeon credentialing. (J Surg Ed 76:745−755. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: video library, methods, surgical education, minimally invasive surgery

COMPETENCIES: Practice-Based Learning and Improvement, Systems-Based Practice

INTRODUCTION

Surgical trainee operative exposure has diminished over the past several years owing to duty hour restrictions, concerns for patient safety, and increasing levels of staff supervision.[1] This necessitates a new approach to trainee education that supplements training with new resources that can minimize the impact of a decrease in surgical exposure and enhance the operative experience that they already receive by preparing to make it more impactful. Advancement in technology in the past decade has incorporated video in text books and, potentially, video atlases will replace text with cartoon imaging owing to the high degree of fidelity and clarity seen in high definition video recordings.[2-4]

Laparoscopic and robotic procedures allow for easy acquisition of high quality surgical video as most operating rooms are outfitted with video recorders within their minimally invasive suites. Video review has been shown to be a useful adjunct in surgical training and credentialing.[5] It has also served as an important resource in studies investigating the correlation between surgeon performance[6,7] and surgeon technique[8-10] to patient outcomes. The process

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of creating and maintaining an extensive video library has not been adequately addressed in the surgical literature.

The goal of this study is to elucidate the methods used in the creation, organization, and maintenance of a surgical video library. We will emphasize its many applications in trainee education, research, and potential utility in surgeon credentialing.

METHODS

This work reports the design, organization, management, and utilization of a video library which began in August 2013 and includes video from 2010 to present. A nonstringent policy on behalf of the institution existed to video all robotic cases when the platform began being utilized in 2008. To protect patient identities, surgeries were saved by date and surgeon initials and not patient names or identifiers. Videos are *never* identified with patient information and are not discoverable. Video recordings are limited to the procedure within the patient's abdomen. The Institutional Review Board at the University of Pittsburgh approved this study and consent was waived (PRO15040497).

The Robotics Curriculum at the University of Pittsburgh consists of 5 steps and the video library constitutes the third step.[11-14] It is chiefly centered around utilizing operative video review as an adjunct to trainee education during the course of their Society of Surgical Oncology and Hepatopancreatobiliary fellowships. Fellows from other subspecialties within general surgery and general surgery residents who have chosen to undergo the curriculum are granted access to the surgical video by the methods mentioned previously. Having the video library for education allows for secondary benefits of scholarly projects.

Operating room video recording capabilities have evolved over the course of the study. Initially, videos were stored on DVDs and when size needs and capabilities grew with high definition and operative volume, it necessitated the use of transfer via external hard drives. Currently, videos are recorded using an AIDA recording system (KARL STORZ SE & Co. KG, Tuttlingen, Germany). It is then automatically uploaded on a cloud-based system using Stryker Studio3 (Stryker, Kalamazoo, MI). The option of downloading onto external hard drives and transferring to computers remains available. Videos from both laparoscopic and robotic procedures are recorded. The group's primary focus has been on robotic procedures, however, but both modalities can be utilized with the same set-up.

Incorporation of Past Videos into Library

All videos were collected from DVDs stored in the operating room or surgical office, from video capture devices from all robotic operating rooms at 3 hospitals, and from hard drive back-ups within the operating room. Once these were collected they were transferred to large external hard drives and categorized by hospital, then by organ, then by procedure, then by year, then by date to create a "Catalog." Videos were cross-referenced with the surgical calendar and operation note as necessary for correct procedure identification and naming since only date and surgeon known.

Incorporation of Videos on Monthly Basis

Currently, a more rigorous system has been set in place to maximize surgical video yield (Fig. 1). Videos are downloaded at the end of each month by research staff from the Stryker System. They are then catalogued according to surgery as described above. The type of surgery is confirmed with the operative note, with researchers relying on operation date, surgeon name, hospital, and the surgical schedule to determine the naming and description to accompany each video. Videos are edited to remove unnecessary segments. The Research Fellow breaks down the full video into procedure specific steps and exports them in 1× speed (Table 1). The full surgery is exported at 4× speed.

Researcher Training

At the program's beginning, all videos were edited by an attending assisted by a part time researcher with video editing skills until a reproducible flow and organization system was achieved. At this point, research assistants were trained to continue the library on a monthly basis. Upon joining the team, the attending trains the research fellow in recognizing these specified steps and editing the video. The attending surgeon edits 3 to 5 videos with the research fellow observing over the span of a week. The research fellow is then given a set of videos to edit. A random sample of these videos is then checked by the attending. If it appears to be adequate, the fellow is instructed to proceed. Every 3 months, videos are checked by the attending with the research fellow to ensure quality of work. This process is repeated with every new hire. The research fellow is typically an international medical graduate who spends 2 years in our program before proceeding to continue their surgical training or an international surgeon doing a robotic research fellowship.

Video Database

These videos are then stored on LaCie drives (Seagate Technology, Paris, France). Researchers keep paper copies of notes while editing (Table 2) and include objective data within an excel database of video details including comments on their contents, quality (identify possible teaching or presentation worthy videos) and the

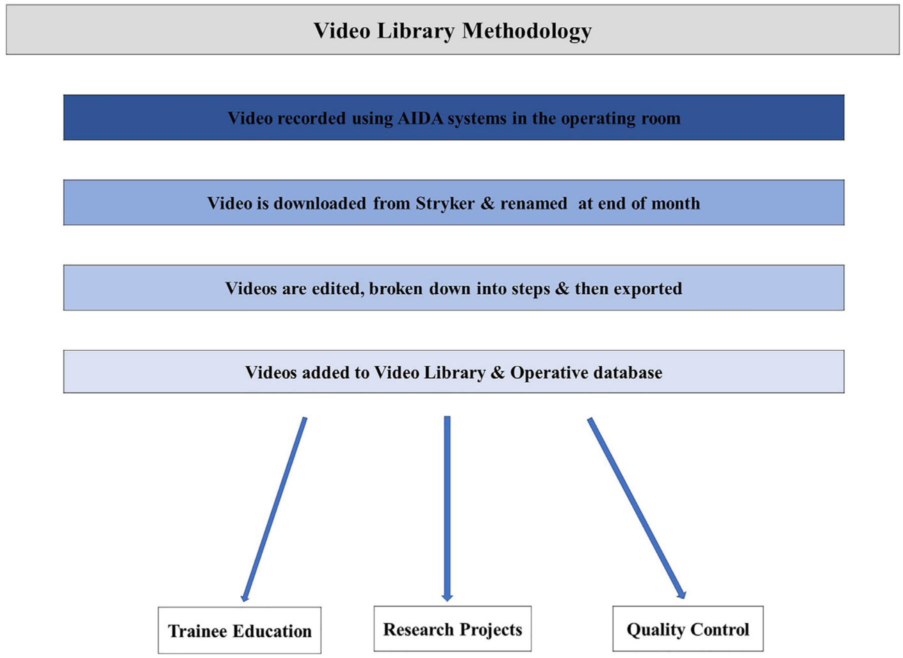

FIGURE 1. Video library methodology flow chart.

durations of each step. Table 2 illustrates the hard copies of these records. Such forms are used as a guide by the research fellow in the course of editing the video. Comments are written in the "Notes" section on the quality of the video image, whether the video includes all the steps, whether the surgery was aborted and why, if there was an unusual or special step rendering the video unique (such as an arterial resection), and if there are any questions for the attending.

Research Resource

These raw footage videos from the library are used for trainee education preoperatively as well as providing feedback and coaching through video review with an attending surgeon. However, once the raw footage is organized within a video library, these can easily be utilized in projects. Edited videos and their segments are intended for use in research projects on surgeon performance and techniques, and their correlation with postoperative outcomes. The video library database breaks the procedure into different steps which include time and who performed the step from the robotic console. Fellows are required to submit surgical case logs at the end of every month (Fig. 2). The fellows make note of the cases they participated in and whether they were assisting or the console surgeon. For pancreas, a complex database is created merging: (1) video library, (2) fellow case logs, and (3) clinical databases. Researchers cross-reference case logs with operative reports and then add this data to the education database which includes both the video data as well as certain pertinent clinical data such as demographic variables, preoperative variables, intraoperative findings, pathology, and postoperative data.

When editing video for a specific project or presentation, the principle investigator on the project and the first author meet with the research fellow and clarify their requests. They indicate the specific procedure, steps and/or time-frame they will look at and the research fellow retrieves the video performing the requested edits and providing the necessary video for review or use in the project.

Video Editing

Editing is done on an iMac (Apple Computer Inc., Cupertino, CA), owing to increased processing power and reliability. For editing, Adobe Premiere (Adobe Systems, San Jose, CA) is used for its versatility, reliability, and availability of discounted subscriptions for educational institutions. External LaCie drives are used for video storage. Dissemination of nonidentified surgical video is best accomplished using Vimeo Pro (InterActiveCorp, New York City, NY). A subscription on Vimeo Business allows for up to 5TB of video with no weekly limits. Researchers identify cases with high quality video and upload them to the site. The platform is user friendly and runs

TABLE 1. Robotic Video Library by Procedure and Step

Organ	Procedure	Video #	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
Pancreas	Whipple	353	Mobilization	Porta	Uncinate	GB	PJ	HJ	GJ	
	Distal	154	Mobilization	Stapling	Removal	GB/Other				
	Appleby	12	Mobilization	Neck	Body & Tail	Celiac				
	Central	11	Roux	Neck	Central	PJ	Omental Flap			
	Enucleation	12	Mobilization	Pan. Mobilization	Enucleation	GB				
	Frey	2	Mobilization	Roux	Duct Incision	PJ	Roux-en-Y			
	Cysgastrostomy	35	Open Stomach	Debridement	Closure	GB				
	Puestow	2	Mobilization	Roux	GB	Panc. Duct	PJ	Mes. Closure		
	Total	13	Mobilization	Porta	Uncinate	GB	Body & Tail	HJ	GJ	AI
Adrenal	Adrenal	8	Mobilization	Resection						
Bile Duct	Excision	9	Mobilization	Resection	Roux	Stump Closure	HJ			
	Bypass	1	Roux	HJ	GJ	GB	Other			
	Repair	1	Mobilization	Resection	Roux	Stump Closure	HJ			
Colon	APR	4	Port Placement	Vascular Pedicle	WLoT	Splenic Flexure	Rec. Rxn	Ostomy		
	LAR	37	Port Placement	Vascular Pedicle	WLoT	Splenic Flexure	Rec. Rxn	Ostomy	Ana.	
Duodenal	Transduodenal	9	Mobilization	Open	GB	CBD Exploration	Duo. Rxn	Closure		
	Sleeve	9	Mobilization	Open	GB	CBD Exploration	Duo Rxn	Closure		
Gastric	GJ	19	Mobilization	GJ	J-Tube					
	Subtotal	26	Gastrectomy/LN	Reconstruction	Other					
	Total	12	Gastrectomy/LN	Reconstruction	EJ	Duo. Stump	J-Tube			
	Wedge	17	Gastrectomy/LN	Reconstruction	Other					
Liver	Wedge	24	GB Adhesiolysis	Hilar Dissection	U/S & Liver Mark	Liver Rxn				
	Segment	40	GB Adhesiolysis	Hilar Dissection	U/S & Liver Mark	Liver Rxn				
	Gallbladder	108	Fossa	Cystic Structures	Other					
	Lobe	9	GB Adhesiolysis	Hilar Disse nction	U/S & Liver Mark	U/S & Liver Mark	Liver Rxn			
	HAI	20	GB Adhesiolysis	Hilar Dissection	Artery Isolation	Pump & U/S				

APR, abdomino-peritoneal resection; LAR, low anterior resection; GJ, gastrojejunostomy; HAI, hepatic arterial infusion pump; LN, lymphadenectomy; GB, gallbladder; Pan. Mobilization, pancreas mobilization; EJ, esophago-jejunostomy; HJ, hepaticojejunostomy; PJ, pancreatojejunostomy; Panc. Duct, pancreatic duct dissection; CBD Exploration, common bile duct exploration; Duo. Stump, duodenal stump; U/S & Liver Mark, ultrasound and liver marking; Duo. Rxn, duodenal resection; Liver Rxn, liver resection; Rectal Rxn, rectal resection; Ana., anastomosis; Pump & U/S, HAI pump placement and ultrasound; AI, auto islet.

TABLE 2. Distal Pancreatectomy Time Stamp Form

Hospital
Project File Name

		Step	1	2	3	4
	Content	Distal pancreatectomy	Mobil1zation	Stapling	Removal	Gallbladder/Other
	Title	Full Surgery	Step 1	Step 2	Step 3	Step 4
	Speed	4x	1x	1x	1x	1x
	Total time					
NOTES	Project file name					
		Start time	End time:	Notes		
	Step 1					
	Step 2					
	Step 3					
	Step 4					
			step 1 notes (Check one): ☐Laparoscopic ☐Robot ☐Missing			
Total video size						
Edited video size						
Additional procedure notes						

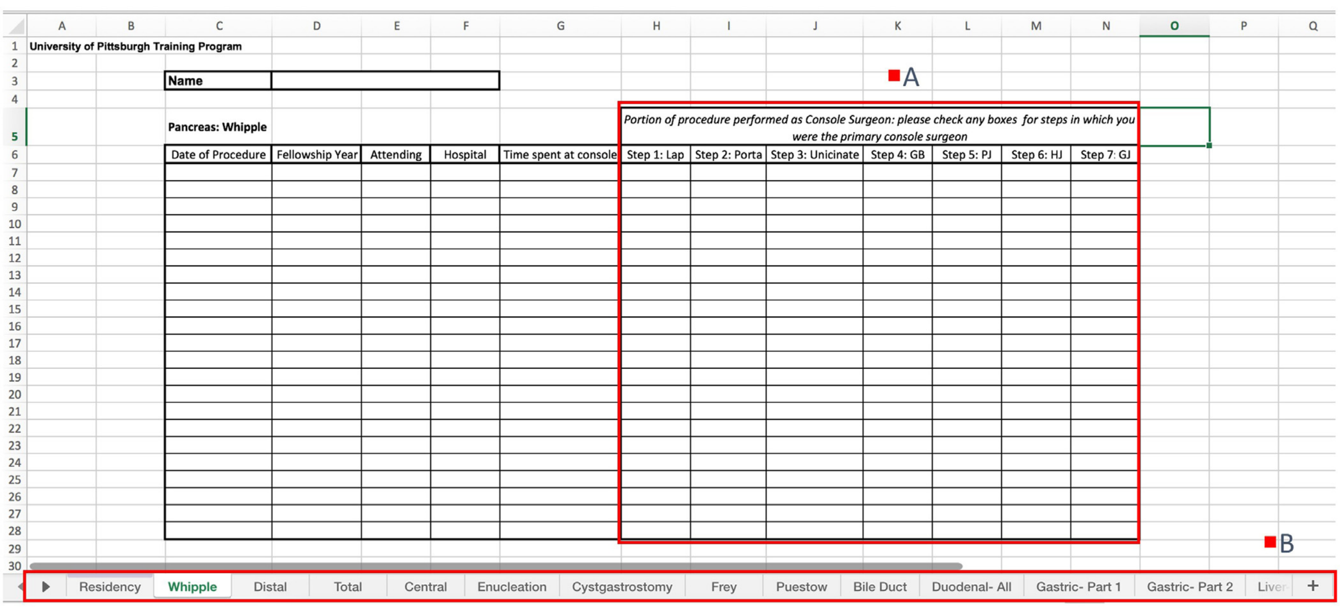

FIGURE 2. Fellow robotic case log A— by steps B— by procedure. HJ, hepaticojejunostomy; GJ, gastrojejunostomy; PJ, pancreatojejunostomy.

on most devices both within and outside the hospital network. Deidentified videos can also be disseminated on external hard drives.

The video library requires a part-time research assistant or trainee to download, edit, export, and store the video on external drives. They also keep a database on these videos.

RESULTS

Catalog

The video library contains 929 cataloged surgical videos from over 14 surgeons within a division. These include many surgical procedures, but primarily consist of robotic pancreatoduodenectomies (RPDs) and robotic distal pancreatectomies (RDPs) (Table 2). Since 2013, the video library has included over 80% of all robotic RPDs and RDPs performed at the institution. Currently, over 110 videos on the Vimeo website are available for immediate viewing. These videos are available to fellows, residents, and visiting surgeons participating in robotics training at our institution. They are provided via a password protected link to these individuals.

Intraoperative Metrics

Breaking up procedures into steps allows for estimation of time to complete each step as trainees are integrated into the console. The RDP steps include: (1) mobilization of stomach and splenic flexure, (2) stapling splenic artery, pancreas, and splenic vein, and (3) retroperitoneal and splenic dissection. The median times to complete each step based on video review were step 1 = 33 minutes, step 2 = 49 minutes, and step 3 = 24 minutes. These steps can also be ordered by difficulty for deliberate integration into the operation. Figure 3 illustrates an integration plan for the RPD for new trainees on service. RPD is more complex and consists of the 7 steps shown. Typically, trainees who do not complete the procedure by the median times established or perform poorly are taken off the console. The library allows for calculation and integration for every procedure in similar fashion.

Case Logs

Thirty fellows have graduated since the case log system was put into place. All fellows were granted robotic privileges at their new institution based on these case logs without requiring additional training. Three fellows had to submit video of their operative performance for credentialing purposes which were taken from the video library. Logs of these fellows have shown that over this

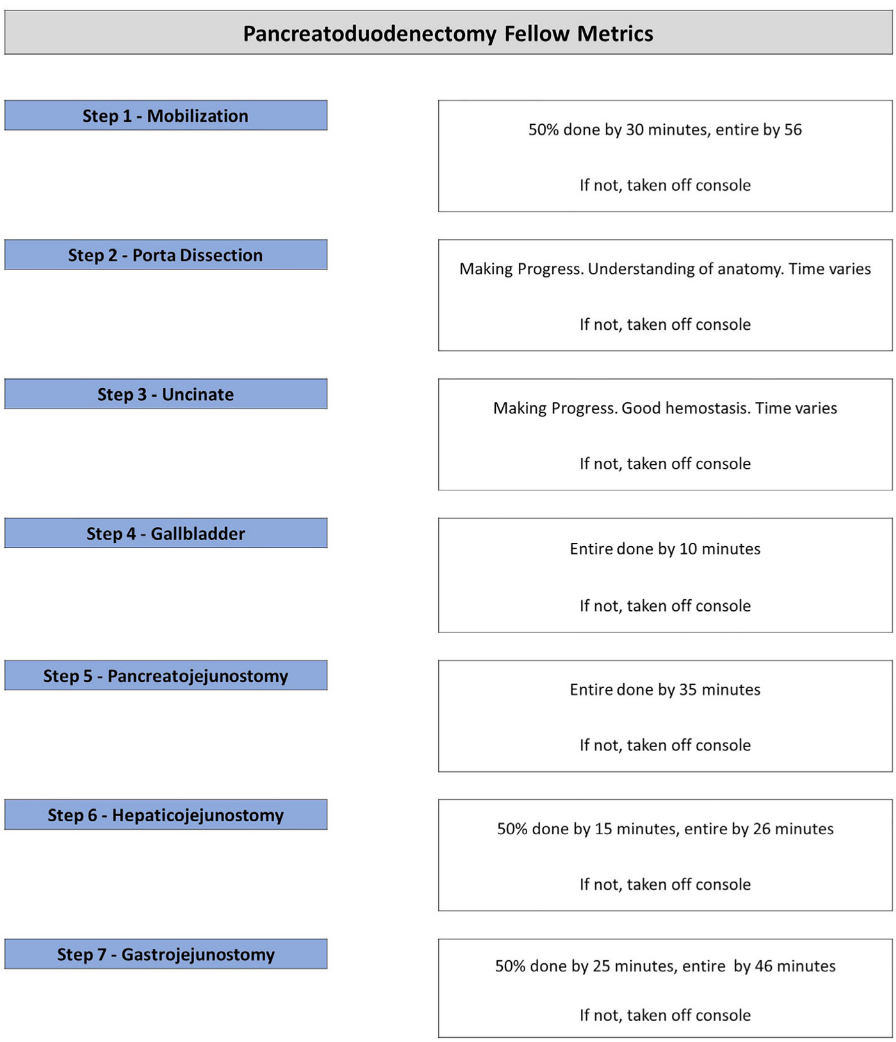

FIGURE 3. Fellow operative curriculum for robotic pancreatoduodenectomy.

TABLE 3. Total Cases by Procedure and Fellow Case Participation

Surgery	Total Cases	None	Part	All	% Console
Whipple	269	23	232	14	91.4%
Distal	122	19	37	66	84.4%
Other pancreas	75	13	41	21	82.7%
Liver	100	15	57	28	85.0%
Bile duct	21	5	13	4	81.0%
Gallbladder	114	8	15	92	93.9%
Gastric/Duodenal	66	10	35	20	83.3%
Colorectal	102	27	47	28	73.5%
Thyroid	21	21	0	0	0.0%
Other	38	3	15	20	92.1%

time period, fellows have operated at the console on 84.6% of surgeries (Table 3).

Scholarship Opportunities

Currently 2 learning curve studies are ongoing now with the education databases that include video library, case logs, and clinical outcomes. The group has already published its outcomes for the learning curve of RPD and RDP. This logging system allows for calculation of a second and third generation learning curves of attendings and fellows adopting platform with video review to assess technical performance and clinical databases to correlate with patient outcomes.

The video library also includes 102 short videos. Seven of these videos were submitted as part of an accepted manuscript. Thirteen of these videos were submitted to a national meeting for presentation. Twenty-seven videos were submitted with book chapters written by the group. Additionally, at least 55 videos were created to augment society research presentations and invited lectures for the trainees and attendings.

Currently, 3 publications and 2 works in progress are dedicated to clinical outcomes in relation to video review of technical performance and techniques. RPD step 5 pancreaticojejunostomy showed an inverse relationship between surgeon technical performance and the incidence of postoperative pancreatic fistula.[7] RPD step 7 gastrojejunostomy showed shorter common enterotomy, efferent angle $>30^{\circ}$ or $<-30^{\circ}$, stapled anastomosis, and sewn by a trainee all as is independent predictors of delayed gastric emptying (DGE).[15] Also on RPD step 2, mishandling blood vessels and suture ligation of the gastroduodenal artery (GDA) were positive predictors of pseudoaneurysm while placement of a falciform flap was a negative predictor of pseudoaneurysm.[16] Ongoing studies are currently looking at surgeon prediction of positive margins by reviewing RPD step 3 retroperitoneal dissection. Also, a study looking at technical skills for RPD step 6 hepaticojejunostomy and relation to long-term stricture is currently being evaluated.

Cost

A researcher updates the databases monthly with this process which requires 3 days of work per-month or approximately 1/10 full-time employee. This includes time for downloading surgical video, editing the video, and storing it on the external LaCie drives. Editing a month of surgical video takes a day and a half. The research fellow breaks up the video into specific steps as previously trained by the attending surgeon. This round of edits serves to provide a video free from blurriness, occasional camera-removals for cleaning as well as produce shorter video segments that encompass critical steps of the procedure. The video library is raw, not polished video. In total, adding this to a research division costs <\$10,000 annually (Table 4).

TABLE 4. Cost Breakdown of Video Library at the University of Pittsburgh

Video Library Component*	Minimum	Maximum
iMac computer for editing†	1200	2000
Lacie drive(s) for storage‡	150	500
Vimeo subscription§	250	500
Adobe creative cloud	200	200
Research fellow (part-time)‖	5000	6000
Total cost	6800	9200

*Costs are assumed according to costs of each item on manufacturer's website, with minimum having the least features and maximum having the most. All costs are shown in U.S. dollars.

†iMac as per the Apple website for the minimum on the iMac with the least features and maximum with the iMac with most features.

‡Minimum assumes use of a 3TB Lacie drive and maximum assumes use of 8TB Lacie drive.

§Minimum assumes use of Vimeo pro plan and maximum assumes use of Vimeo Business.

‖Minimum assumes \$15/h pay for 6 hours a day, 4 days a month for a year, and maximum assumes \$20/h pay for the same duration.

The equipment purchased lasts several years and only 1 computer was purchased initially and has been in use since. The computer is accessible to the research fellow and attendings on the team. The work was later supported by internal funds from the department to maintain subscription and purchase external hard drives when necessary. The research fellow is typically responsible for a variety of tasks, and their salary is provided for from internal department funds. A variety of options exist for the different components of the video library. Institutions need not restrict themselves to an iMac but can also utilize Windows computers that meet the minimum requirements of their chosen editing software. The requirements for Adobe Premiere for both Windows (Microsoft, Redmond, WA) and Mac (Apple, Cupertino, CA) can be found on the product website. Avid (Avid Technology, Burlington, MA), Final Cut Pro (Apple, Cupertino, CA) and DaVinci Resolve (Blackmagic Design, Melbourne, Australia) can serve as alternatives to Adobe Premiere. However, these are more expensive and less intuitive when compared to Adobe Premiere. Alternatives to Vimeo exist, mainly learning management systems, but were rejected for privacy concerns and size restrictions. Table 4 lists the different components of the video library that are used at our institution and their costs. Table 5 offers a nonexhaustive list of potential options for video library components.

DISCUSSION

This paper details how an educational video library was developed at a university hospital. The video library includes 929 videos from robotic surgeries with >100 available online for immediate viewing and >100 short scholarly videos for various endpoints. Maintaining this video library costs less than $10,000 for the first year and less than $6000 for subsequent years. Building a video library has afforded the opportunity to educate surgeons, but more importantly, laying the ground work enables research on surgeon performance and surgical technique and asses its impact on postoperative outcomes. Therefore, creating an educational video library is feasible and is beneficial in research, education, and potential quality control.

Video review has had a significant role in trainee education. In 1 study at the University of Michigan, researchers developed an educational video on lung lobectomy for general surgery residents.[17] Based on a needs assessment, a short video was developed and most residents (75%) found it useful. This showed how video review addressed a need for more directed surgical subspecialty training tools. Video review preoperatively has been also shown to allow for trainee knowledge assessment, as well. In a study at Mayo Clinic, researchers produced 4-minute videos with 5 clips of laparoscopic procedures.[5] The video was shown to the staff of varying levels of experience and viewers were asked to supply structured comments that were graded. More experience correlated with higher scores.

In a randomized controlled trial on video review for laparoscopic inguinal hernia repair, residents were randomized to either the video review or no video review group.[18] Participants in the video review group reviewed videos with 1 attending for 30 minutes every week. Residents were videotaped when serving as the primary surgeon and their performance was rated. Residents in the video review group had significantly better

TABLE 5. Potential Options for Video Library Components

Video Library Component	Potential Options	Minimum Cost ($)
Video editing software	Adobe creative cloud	200
	DaVinci resolve	299
	Final cut pro	300
	Avid*	1299
Video editing hardware	iMac†	1200
	Windows computers‡	900
	LaCie external hard drive§	150
Video dissemination	External hard drive‖	70
	Vimeo pro#	250

*Initial price is $1299 for the first year and $299 for subsequent years.
†iMac as per the Apple website for the minimum on the iMac with the least features.
‡Cost is obtained using the recommended build from Adobe Premiere pro's developer website including the operating system and the necessary computer accessories.
§Assumes use of a 3TB hard drive.
‖Trainees typically purchase their own external hard drives at no cost to the program.
#This assumes use of Vimeo pro plan.

performance as compared to those in the no video review group, highlighting the role of video review in education. At the University of Pittsburgh, the robotics curriculum is comprised of 5 steps (Fig. 4). The third step includes operative video review and coaching. Non-identified videos are provided either through an online platform (Vimeo) or on a hard drive to the trainee preoperatively. These videos help trainees better learn the different planes of tissue dissection, the different operative steps for each surgery, and the time each step is expected to take. Preoperative video review serves to maximize the trainee's attention capacity[19,20] during the surgery so they focus on troubleshooting and hemostasis. The role of attentional capacity is critical in surgery because decisions must be made in real time with limited information that will impact the patient.[21]

Video review serves as a source of metrics for surgeon evaluation and a means to link surgeon performance intraoperatively with postoperative outcomes. In the study by Birkmeyer on surgical skill and complication rates, surgeons submitted video of laparoscopic gastric bypass.[6] Other surgeons were asked to rate each video according to the modified objective structured assessment of technical skills and it was shown that the bottom quartile of surgical skill was associated with higher risk-adjusted complication rates and mortality. Similarly, in our groups' study on postoperative pancreatic fistula incidence and surgeon performance of the pancreatojejunostomy, adding the technical score independently predicted postoperative pancreatic fistula.[7] Currently, there are 2 ongoing projects on surgeon skills and outcomes. These include a study on long-term biliary complications after hepaticojejunostomy and 2 separate, but similar studies, on the second and third generation learning curves in both RPD and RDP which account for surgeon simulation-based training.

Surgeon technique has been shown to play a role in outcomes. In a study by Varban et al. on staple-line leaks in laparoscopic sleeve gastrectomy, it was shown that over-sewing of the staple-line was the only technique associated with less leaks.[10] Analysis on videos of laparoscopic sleeve gastrectomy showed significant variation

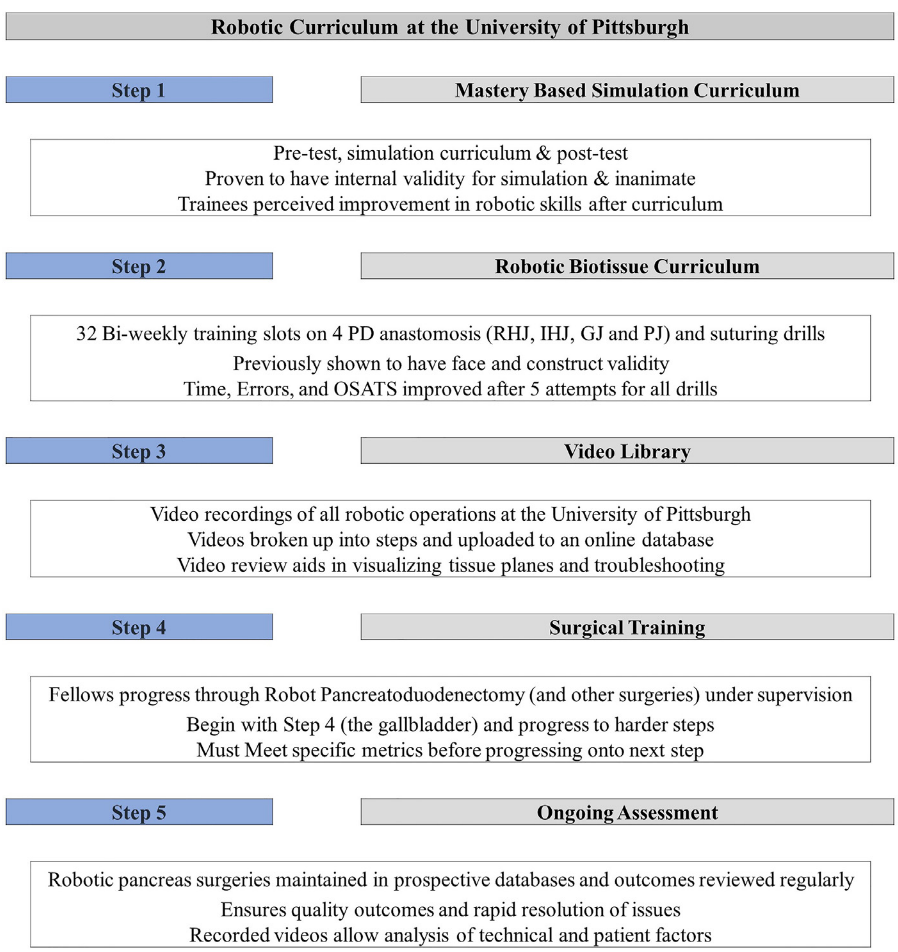

FIGURE 4. Robotic curriculum at the University of Pittsburgh. PD, pancreatoduodenectomy; HJ, hepaticojejunostomy; GJ, gastrojejunostomy; PJ, pancreatojejunostomy.

in time to complete each step, hiatal hernia repair technique, stapling technique, and post-transection staple line management.[9] This underscored the utility of surgical video review in this emerging field. Using the video library, a study was conducted on DGE incidence and surgeon technique.[15] It was shown that gastrojejunostomies done using a suture technique and with longer anastomoses had less DGE. Postpancreatectomy hemorrhage was also found to be linked to surgeon operative technique. It was shown that gastroduodenal artery mishandling and suture ligation predicted pseudoaneurysm formation.[8]

The methods explored above with video recording, editing, and cataloguing principles are directly transferable across specialties and within minimally invasive surgical platforms. With some specialty specific modifications to specific cataloguing techniques, this same framework can be translated: (1) break procedure into common steps, (2) edit raw footage to separate whole video into steps, (3) create database of time and basic metrics from these steps, and (4) use for education or research. Maintenance of a video library requires financial and time commitments on part of the team, however these are mitigated by relying on established research fellows within the department or highly motivated trainees. Training these individuals initially dramatically reduces the time spent by attending surgeons editing their videos whether for research and scholarship or for educational purposes. While learning how to use the software may appear difficult at first, it is made easier through utilizing learning tutorials available online. The applicability of this work is limited to minimally invasive surgical platforms, but the same principles can be further expanded upon to allow for recording open surgical procedures using head-mounted video recording devices.

A limitation of the video library is that it does not include what happens outside the field of view owing to patient privacy concerns and it is well known that port-placement and what happens outside the field of view is important for the success of the surgery. These difficulties can be overcome and the pay-off with the avenues opened by the creation of an extensive video library are significant. Another limitation is that attending time is not accounted for in the costs.

CONCLUSION

A surgical video library is an extraordinary tool in the academic surgical setting. Video review plays a productive role in trainee education both in terms of preoperative preparation and coaching. It serves as a new avenue in research with projects centered around surgeon skill and surgical technique. A video library can be established with minimal cost and time commitment in an academic setting. More studies are necessary to elucidate the impact of video review on trainee operative performance and to construct an evidence-based video review curriculum for trainees of different surgical specialties.

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