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YouTube as a potential training method for laparoscopic cholecystectomy

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Purpose: The purpose of this study was to analyze the educational quality of laparoscopic cholecystectomy (LC) videos accessible on YouTube, one of the most important sources of internet-based medical information.
Methods: The keyword 'laparoscopic cholecystectomy' was used to search on YouTube and the first 100 videos were analyzed. Among them, 27 videos were excluded and 73 videos were included in the study. An arbitrary score system for video quality, devised from existing LC guidelines, were used to evaluate the quality of the videos. Video demographics were analyzed by the quality and source of the video. Correlation analysis was performed.
Results: When analyzed by video quality, 11 (15.1%) were evaluated as 'good', 40 (54.8%) were 'moderate', and 22 (30.1%) were 'poor', and there were no differences in length, views per day, or number of likes, dislikes, and comments. When analyzed by source, 27 (37.0%) were uploaded by primary centers, 20 (27.4%) by secondary centers, 15 (20.5%) by tertiary centers, 5 (6.8%) by academic institutions, and 6 (8.2%) by commercial institutions. The mean score of the tertiary center group (6.0 ± 2.0) was significantly higher than the secondary center group (3.9 ± 1.4, P = 0.001). The video score had no correlation with views per day or number of likes.
Conclusion: Many LC videos are accessible on YouTube with varying quality. Videos uploaded by tertiary centers showed the highest educational value. This discrepancy in video quality was not recognized by viewers. More videos with higher quality need to be uploaded, and an active filtering process is necessary.
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Key Words: YouTube, Gallbladder, Laparoscopic cholecystectomy

INTRODUCTION

In 1999, Darcy DiNucci coined the term 'Web 2.0', which describes websites that allow users to interact with each other as creators of user-generated contents, in contrast to web sites where people are limited to the passive viewing of contents [1]. A widely used example of web 2.0 is YouTube (www.youtube.com), a video sharing website that allows unregistered users to watch videos and registered users to upload an unlimited number of videos. The viewers can express their thoughts on each video by clicking on 'like' or 'dislike', or by leaving a comment. The number of likes, dislikes, and comments, as well as the number of views, are shown beneath the title of each video.

As more people use the internet to access medical information, YouTube is becoming one of the most important sources of internet-based medical information. Accordingly, many authors have published studies assessing the quality of medical information on YouTube. While some studies have focused on videos aimed at the general public [2-4], others have

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focused on videos aimed at the medical professionals [5-7].

Gallstone disease is one of the most prevalent gastrointestinal disorders [8]. The gold standard of treatment for symptomatic gallstone disease is laparoscopic cholecystectomy (LC) [9]. LC is also one of the essential procedures in a surgeon's training program. Due to the video-based characteristic of laparoscopic surgery, YouTube is a potential training aid for young surgeons, but the quality has not been assessed.

The purpose of this study was to analyze the quality of LC videos accessible on YouTube from a procedural point of view, and to assess whether these videos are appropriate for the training surgeon.

METHODS

Study design

YouTube was searched on March 1, 2014 by using the keyword 'laparoscopic cholecystectomy'. Under the assumption that the viewer would not go past the first five pages of the search results, the first 100 videos were analyzed. The surgical videos demonstrating the procedures of LC were included, and the videos with contents other than surgery, such as patient education, 3-dimensional animation, or hospital commercials were excluded. Also, videos demonstrating other procedures such as common bile duct exploration were excluded.

The patient factors and outcome variables were reviewed based on the following: lengths of the videos; sources of the videos (primary center, secondary center, tertiary center, academic institution, or commercial institution); number of views, likes, dislikes, and comments; countries of origin; and surgical techniques (method of access, video score, intraoperative cholangiogram, method of removal, etc.).

Institutional Review Board approval was unnecessary for this study, because only public access data were used.

Outcome measurement

Since there are no established standards for assessing video quality, an arbitrary score system was devised, based on existing LC guidelines [10-13]. The categories comprising the video score and the scoring system for each category are shown in Table 1. The video score consists of seven categories, with a total score of 0 to 10. The following were analyzed: starting point of dissection, the direction of infundibular retraction, demonstration of the critical view of safety (CVS), the sequence of cutting structures, the length of the cystic duct stump, use of electrocautery, and demonstration of final hemostasis. The most importance was given to demonstration of the CVS. Videos with a score of 0 to 3 were deemed as 'poor', 4 to 7 as 'moderate', and 8 to 10 as 'good'.

Three individual researchers evaluated the quality of the video. To minimize the rate of disagreement, specific standards were devised for the each criterion of the video score. In case of disagreement, all three researchers conferred and decided on an appropriate score.

Statistical analysis

The data was analyzed with IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA). Continuous variables were compared

Table 1. Video score

Category	Assessment	Score
Starting point of dissection	Inappropriate	0
	At junction of gallbladder and cystic duct	1
Infundibular retraction	Cranial retraction	0
	Not cranial, but not ventral or lateral	1
	Ventral or lateral retraction	2
Demonstration of CVS	Not demonstrated	0
	Fat and tissue dissected from triangle of Calot	1
	Also, only two structures seen entering gallbladder	2
	Also, lower gallbladder dissected off liver bed	3
Sequence of cutting	Cystic duct divided first	0
	Cystic artery divided first	1
Length of cystic duct stump	Less than 1 mm	0
	1 mm or more	1
Use of electrocautery	Used near common bile duct	0
	Not used near common bile duct	1
Demonstration of hemostasis	Not demonstrated	0
	Demonstrated	1
Total score*		0–10

CVS, critical view of safety.
*Total score: 0–3, poor; 4–7, moderate; 8–10, good.

using Kruskal-Wallis analysis, with *post hoc* analysis using the Mann-Whitney test. The Bonferroni method was used to set the significance method. Spearman rank coefficient was used to analyze correlation. A weighted kappa score was calculated to evaluate interobserver variability.

RESULTS

One hundred videos were analyzed. Among the 100 videos, 27 were excluded and 73 videos were included in the study. Of the 27 excluded videos, 12 videos contained contents other than LC such as hospital promotion, 8 were incomplete videos, and 7 were duplicates.

Table 2. Analysis by video quality

Demographic	Video quality			Total	P-value
	Good	Moderate	Poor		
Videos	11 (15.1)	40 (54.8)	22 (30.1)	73 (100)	-
Score	8.4 ± 0.5	5.4 ± 1.0	2.9 ± 0.3	5.1 ± 1.9	<0.001[a]
Length (min)	7:45 ± 3:26	12:15 ± 11:13	12:59 ± 12:59	11:48 ± 11:03	0.469
Views (n)	36,961 ± 111,535	24,459 ± 60,644	8,410 ± 13,655	21,506 ± 62,193	0.823
Days online	669 ± 531	710 ± 587	640 ± 258	682 ± 496	0.825
Views per day	21.6 ± 57.3	24.6 ± 54.5	15.2 ± 27.6	21.3 ± 48.0	0.958
Likes (n)	18.4 ± 44.1	22.9 ± 25.7	10.3 ± 9.0	18.3 ± 26.1	0.370
Dislikes (n)	2.3 ± 5.9	2.8 ± 6.0	2.4 ± 3.4	2.6 ± 5.3	0.649
Comments (n)	12.3 ± 34.5	12.5 ± 28.1	4.8 ± 6.7	10.1 ± 24.9	0.612
Upload source					
Private practice	4 (36.4)	16 (40.0)	7 (31.8)	27 (37.0)	-
Secondary hospital	1 (9.1)	7 (17.5)	12 (54.5)	20 (27.4)	-
Tertiary hospital	5 (45.5)	9 (22.5)	1 (4.5)	15 (20.5)	-
Academic institution	1 (9.1)	3 (7.5)	1 (4.5)	5 (6.8)	-
Commercial institution	0 (0)	5 (12.5)	1 (4.5)	6 (8.2)	-

Values are presented as number (%) or mean±standard deviation.
[a]All comparisons (poor *vs.* moderate, poor *vs.* good, moderate *vs.* good).

Table 3. Analysis by video source

Demographic	Video source					Total	P-value
	Primary	Secondary	Tertiary	Academic	Commercial		
Videos	27 (37.0)	20 (27.4)	15 (20.5)	5 (6.8)	6 (8.2)	73 (100)	-
Score	5.3 ± 2.0	3.9 ± 1.4	6.0 ± 2.0	5.8 ± 2.3	5.0 ± 1.4	5.1 ± 1.9	0.009[a] 0.001[b]
Length (min)	13:56 ± 13:34	12:10 ± 11:11	9:55 ± 9:16	10:16 ± 3:27	6:57 ± 2:46	11:48 ± 11:03	0.503
Views (n)	36,520 ± 90,140	12,026 ± 15,415	5,678 ± 18,505	2,333 ± 1,880	41,085 ± 91,797	21,506 ± 62,193	0.001[c]
Days online	789 ± 606	597 ± 302	427 ± 383	560 ± 336	1,223 ± 357	682 ± 495	0.021[d]
Views per day	32.3 ± 68.9	21.2 ± 29.4	6.2 ± 17.6	4.0 ± 1.7	24.1 ± 52.5	21.3 ± 48.0	0.064
Likes (n)	26.3 ± 37.1	17.5 ± 16.2	10.3 ± 14.9	14.4 ± 15.9	7.5 ± 11.1	18.3 ± 26.1	0.057
Dislikes (n)	3.6 ± 6.9	2.9 ± 3.8	0.7 ± 2.1	0.4 ± 0.5	3.8 ± 8.0	2.6 ± 5.3	0.075
Comments (n)	14.4 ± 31.2	8.7 ± 10.1	2.4 ± 7.0	0.6 ± 1.3	22.7 ± 52.6	10.1 ± 24.9	0.024[e]
Video quality							
Good	4 (14.8)	1 (5.0)	5 (33.3)	1 (20.0)	0 (0)	11 (15.1)	-
Moderate	16 (59.3)	7 (35.0)	9 (60.0)	3 (60.0)	5 (83.3)	40 (54.8)	-
Poor	7 (25.9)	12 (60.0)	1 (6.7)	1 (20.0)	1 (16.7)	22 (30.1)	-

Values are presented as number (%) or mean ± standard deviation.
[a]Primary *vs.* secondary. [b]Secondary *vs.* tertiary, P < 0.005, statistically significance. [c]Secondary *vs.* tertiary, P < 0.005, statistically significance. [d]Primary *vs.* tertiary; primary *vs.* commercial, P = 0.040; secondary *vs.* tertiary, P = 0.039; secondary *vs.* commercial, P = 0.039; tertiary *vs.* commercial, P = 0.003; academic *vs.* commercial, P = 0.030. [e]Primary *vs.* tertiary; secondary *vs.* tertiary, P < 0.001; secondary *vs.* academic, P = 0.003.

The videos included in the study were categorized by video quality and upload source. Table 2 shows the demographics of videos by quality. Among 73 videos, 11 (15.1%) were evaluated as 'good', 40 (54.8%) were 'moderate', and 22 (30.1%) were 'poor'. Since the categorization was based on video quality, significant differences were noted in the mean score between all groups ($P < 0.001$). The mean scores were 8.4 ± 0.5 for the good video quality group, 5.4 ± 1.0 for the moderate video quality group, 2.9 ± 0.3 for the poor video quality group, and 5.1 ± 1.9 for the entire group.

There were no differences in the lengths of videos, views per day, or number of mean likes, dislikes, and comments. Most of the good videos were uploaded by tertiary centers (45.5%), whereas most of the poor videos were uploaded by secondary centers (54.5%).

Table 3 shows the demographics of videos by upload sources. Twenty seven (37.0%) were uploaded by primary centers, 20 (27.4%) by secondary centers, 15 (20.5%) by tertiary centers, 5 (6.8%) by academic institutions, and 6 (8.2%) by commercial institutions. The mean score of the tertiary center group (6.0 ± 2.0) was significantly higher than that of the secondary center group (3.9 ± 1.4). The number of mean views was significantly higher in the secondary center group, compared to the tertiary center group. There were no differences in views per day or number of mean likes, dislikes, and comments. Most videos included in the primary and tertiary center groups were of a moderate quality (primary 59.3%, tertiary 50.0%), but in the secondary center group, most videos were poor (60.0%).

A correlation analysis was performed. The video score had no correlation with views per day or number of likes, dislikes, and comments. However the views per day and the number of likes, dislikes, and comments all had a positive correlation with each other.

The interobserver variability, calculated as a weighted kappa score, was 0.80 between researcher 1 and 2, 0.77 between 2 and 3, and 0.90 between 3 and 1.

DISCUSSION

YouTube is a website that was established in 2005. It has grown in size, to become one of the most popular websites in the world. In 2007, Keelan et al. [14] reported their results of analyzing immunization videos on YouTube. Since then, the number of studies published on this medical topic has been steadily increasing. These studies come from the various fields of medicine from pediatrics, orthopedics, and internal medicine. This study is the first one to evaluate the videos on general surgery procedures on YouTube.

Compared to open surgery, laparoscopic surgery is easier to record. In an open surgery, a separate video camera has to be set up to record the procedure. But in laparoscopic surgery, the entire procedure is already being performed through the videoscope. Also, in an open surgery, there is a considerable discrepancy between the surgeon's field of vision during the surgery and the recorded view. But in a laparoscopic surgery, the video shows exactly what the surgeon was viewing during the procedure. Due to these characteristics, many videos of laparoscopic surgery procedures have been uploaded on YouTube, and many viewers are watching them.

In this study, LC videos were analyzed. The potential viewers, of LC videos uploaded on YouTube, can be placed into the two broad categories, medical personnel and individuals seeking medical information. Medical personnel include medical students, surgical interns and residents, and active surgeons seeking to learn or master LC. Individuals seeking medical information would include the patients who are scheduled to undergo LC, family members of such patients, or individuals seeking information on LC for other reasons. Providing these individuals with the details of surgery are important to help them make informed decisions about their treatments. However, for the viewers who are medical personnel, demonstrating each step of the surgical procedure may have tremendous educational value.

In a recent article, the authors have analyzed YouTube videos on gallstone disease [15]. In conclusion, more than half of the videos had misleading contents. Also, the quality of videos did not correlate with the number of views or number of likes. The results of the present study were in line with these findings. As shown in Table 2, the number of likes, dislikes, and comments did not differ according to the video quality. Also, the correlation analysis showed no correlation between the video score and the number of likes, dislikes, and comments. It can be inferred that the videos of poor quality are equally viewed as much as the videos with higher quality. Also, the preference of the viewers did not seem to differ between these videos. The results on Table 3 show that the videos uploaded by the tertiary centers had a significantly higher mean score compared to that of the secondary centers. But the number of views was significantly lower in the tertiary center group. This finding may have limited significance, since the number of views per day did not differ. All things considered, it seems that videos of the tertiary center group have better quality than that of the secondary center group, yet the viewers are not showing differences in their preference between the two groups. Out of 15 videos uploaded by tertiary centers, 5 (33.3%) demonstrated CVS. In contrast, out of 20 videos uploaded by secondary centers, only 2 (10%) videos demonstrated CVS. Since many tertiary centers are teaching hospitals, the surgeons may have been more familiar with the concept of CVS. It can be inferred that the purpose of these videos from the secondary centers was to promote and advertise their hospitals, rather than to teach novice surgeons.

The standard procedure in LC uses 4 trocars. Many authors have published studies evaluating alternative methods for using less trocars. In our study, 50 videos (68.5%) used 4 trocars, 9 (12.3%) used 3 trocars, and 14 (19.2%) used a single incision. In the case of single incision laparoscopic surgery (SILS), the lack of triangulation makes the surgery difficult. There is evidence that CVS is necessary even in SILS [16], but in most videos using SILS, CVS was not demonstrated. But some videos demonstrated CVS even in SILS, by using intracorporeal suture to retract the fundus. With the fundus retracted, one instrument can be used to retract the infundibulum laterally, exposing the triangle of Calot. After dissection, CVS can be demonstrated. A recent study concluded that postoperative pain is most severe after LC with 4 trocars, when compared to the methods using less trocars [17]. In a different study, no significant advantages were noted in the surgery using fewer than 4 ports [18]. Even with contradictory evidence, performing surgery with less trocars has obvious advantages for the patient. However, if a novice surgeon who has not yet mastered LC, attempts to perform surgery using fewer than 4 ports, there is a risk of complications.

As discussed before, there has been a surge in articles evaluating YouTube videos. A recent systematic review concluded that YouTube holds a vast amount of data regarding health care, some of which are incorrect or misleading [19]. But a standard method of analysis has not yet been established, so the analyzing methods widely vary according to the authors. There have been efforts to establish guidelines for analyzing YouTube video contents, which gave limited results [20]. A standard guideline is necessary for the future research.

This study has several limitations. We used a 'snapshot' analysis and the contents of videos may change over time. Also, the videos were searched in the order of relevance, which is the default setting for sorting on the YouTube website. The results may change if the videos were sorted in a different order.

In conclusion, there are many YouTube videos demonstrating LC with a wide range of video quality. Videos uploaded by tertiary centers showed the highest educational value. The discrepancy in video quality was not recognized by the video viewers. More videos with higher quality need to be uploaded, and an active filtering process should be implemented on the YouTube website.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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