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## Barriers Against and Improvement Measures of Discussion During Bilateral Video-Conferencing in an Early Gastric Cancer Case Study

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### Abstract

Japan has a high diagnostic rate of early gastric cancer (EGC), and doctors worldwide are eager to learn advanced tips and skills from Japanese experts. The Telemedicine Development Center of Asia has carried out endoscopy-themed teleconferences, to educate overseas doctors about diagnosing EGC, from which video data are analyzed. The number of comments made varied based on the participant's role in the teleconference. The experts and chair made more comments than the audience participants. Because in-depth discussion about each case study with the experts is important in learning advice for EGC diagnosis, in this paper, we further analyzed the reasons why there were so many silent participants and how to activate discussion by them. We learned that most hesitated when the discussion was concentrated between the experts. Live polling was added to the teleconference to increase activation. Although a direct increase in the number of comments was not seen, the proportion of participants who had questions but remained silent decreased by 53%, and 88% of participants stated that the live polling increased the quality of the discussion. We found that live polling provides valuable feedback to the chair so that the discussion could incorporate the participants' opinions, and thus, it increased the quality of the discussion phase.

### Keywords:

Telemedicine, Early Gastric Cancer, Interaction, Teleconferencing, Endoscopy

### Introduction

The mortality rate of gastric cancer in Japan and Korea is very low compared with the incidence rate. The 5-year survival rate for patients diagnosed with early gastric cancer (EGC) in Japan is approximately 90% [1]. However, in other parts of the world, such as Russia and Central Asia, the mortality and incidence rates are similar [2]. The reason for this significant difference is thought to be advances in EGC diagnosis in Japan. At present, 70% of gastric cancer cases are found at the early stage in Japan (compared with more advanced stages in other countries). Knowledge and experience are essential for EGC diagnosis. Knowledge should be gained not only by listening to lectures but also through in-depth discussions with experts to obtain specific advice. Furthermore, each endoscopist's individual experience with EGC diagnosis is limited. Therefore, the joining of many case conferences is needed to gain experience. Repetitive discussions based on endoscopic and

pathological findings have been held over 40 years to establish EGC diagnosis guidelines. This has been responsible for the high EGC diagnosis rate in Japan.

Therefore, endoscopists in many countries seek education from Japanese endoscopy experts. Although learning face-to-face from Japanese experts is very meaningful for establishing practitioners' EGC diagnosis abilities, it is costly and time-consuming. Teleconferencing is an effective method to overcome such time and cost barriers, especially during the COVID-19 pandemic, when travel is restricted. Bilateral videoconferencing systems can be used to connect multiple institutions, where education between endoscopists is conducted through teleconferencing.

Research has reported that technical factors such as image and audio quality affect the quality of teleconferences. Thus, additional care is needed to prevent technical issues from disrupting teleconferences [3-4]. E-learning studies have described how involvement in the program affects the participants' satisfaction [5-6]. One example is that involvement in a discussion has been measured in terms of interaction with the same topic [5]. Furthermore, it is important for the teaching side to involve the learning side in the discussion [6]. Another study concluded that the number of comments from the learning side affected the level of comprehension, as the teaching side can provide additional explanation in accordance with the comments [7]. Similar to e-learning situations, discussions with experts are important for learning EGC diagnosis. However, to the best of our knowledge, there are limited studies concerning the discussion of EGC case studies via bilateral teleconferencing. In this study, we focused on the discussion phase of teleconferences. Because the discussion of some cases during the investigated teleconferences was not very active, we analyzed what aspects kept participants from joining the discussion and how to activate the participants to join the discussion phase.

### Materials and Methods

#### Endoscopy Teleconference with Russia

The Telemedicine Development Center of Asia at Kyushu University Hospital, Japan, has operated a program called "Endoscopy Teleconference with Russia" in collaboration with Russian medical institutions since November 2017. The latest (8<sup>th</sup>) teleconference was held in March 2020. The connecting institutions included medical and educational institutions throughout Russia (Moscow, Yaroslavl, Novosibirsk, Nizhny Novgorod, Vladivostok, and Khabarovsk), Kyrgyzstan (Bish-

kek and Osh), and Japan (Tokyo, Osaka, and Fukuoka), as shown in Figure 1. The main topic was clinical case studies of EGC, and the presentation material included general patient information, still or moving images of endoscopy procedures, pathological images, and strategies for further treatment. Two to three presentations were given by the Russian side explaining their diagnosis of each case. Then, the chair organized a discussion between the Japanese experts and the participants at the remote sites to deepen the group's understanding of each case study. We analyzed the following items from each teleconference's recorded data: number of connecting institutions, number of participants, and number of comments made. Figure 2 shows an example scene from the 8<sup>th</sup> teleconference. The endoscopy image being discussed is shown in the center, and the connected participants are shown at the right and bottom.



Figure 1- Locations of connecting institutions

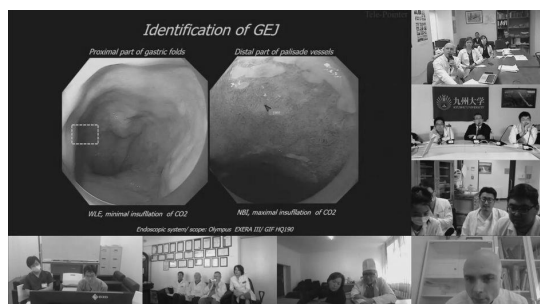


Figure 2- Example scene from the 8<sup>th</sup> teleconference

### Technical information about videoconferencing system

The videoconferencing system was provided by Vidyo (Hackensack, NJ). Our center used a dedicated hardware system called VidyoRoom, which provides high-quality image transmission. Most of the remote sites connected using the Vidyo-Desktop software package. Several sites connected via VidyoGateway using H.323 hardware devices from providers such as Cisco (San Jose, CA) and Polycom (Santa Cruz, CA). Presentation materials were shared using VidyoRoom's content sharing function. In addition, a system called TelePointer (Tokyo, Japan) was used to share the mouse cursor on the endoscopy or pathological images between multiple sites to specify exact locations of the lesion during the discussion.

### Questionnaire after each teleconference

After each teleconference, the participants were asked to complete a questionnaire regarding the quality of image sharpness, image movement, and audio to analyze any technical issues that may have disrupted the teleconference. For the version of the questionnaire used for the 7<sup>th</sup> teleconference, we added a

question asking whether the participants had questions during the discussion phase. If yes, the participants were asked why they did not ask their questions. For the version of the questionnaire administered after the 8<sup>th</sup> teleconference, we added questions about the participants' opinions regarding the newly added live polling.

### Live polling

Live polling using the Mentimeter system (Stockholm, Sweden) was newly added to the 8<sup>th</sup> teleconference. Questions were asked during each presentation, and the results were shared after the participants answered. The chair organized the discussion according to the results. The questions asked during the live polling involved tumor location, type of lesion, suspicion of deep submucosal invasion, recommendation to perform endoscopic ultrasound, treatment strategy, and follow-up strategy.

## Results

### Image and audio quality

Figure 3 shows the quality results in terms of image sharpness, image movement, and audio. Of all questionnaire respondents, 94% (103, n=110), 95% (102, n=108), and 90% (97, n=108) answered positively regarding the quality of image sharpness, image movement, and audio, respectively.

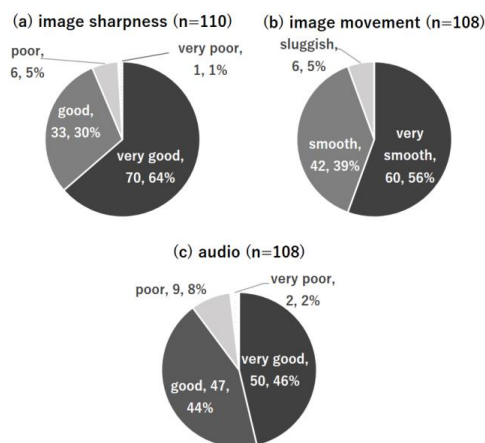


Figure 3- Questionnaire results on quality of (a) image sharpness, (b) image movement, (c) audio

### Overall results of all teleconferences

A total of eight teleconferences were held. The numbers of connecting institutions, participants, comments, and meeting durations are shown in Table 1. The numbers of participants and comments were divided into the number of experts and the number of other participants and the comments made by experts and other participants. Experts were defined as doctors with 15 or more years of endoscopy experience and the Russian chair. Other participants were those who did not fit the above roles. The numbers of connecting institutions and participants varied during the eight teleconferences.

Table 1- Overall results of all teleconferences

| Teleconference Number | Number of institutions | Number of participants | Number of experts | Number of other participants | Duration (min) | Total number of comments | Comments from experts | Comments from other participants |
|-----------------------|------------------------|------------------------|-------------------|------------------------------|----------------|--------------------------|-----------------------|----------------------------------|
| 1 <sup>st</sup>       | 5                      | 21                     | 7                 | 14                           | 60             | 24                       | 16, 67%               | 8, 33%                           |
| 2 <sup>nd</sup>       | 9                      | 44                     | 5                 | 39                           | 90             | 48                       | 30, 63%               | 18, 37%                          |
| 3 <sup>rd</sup>       | 12                     | 49                     | 5                 | 44                           | 90             | 47                       | 44, 94%               | 3, 6%                            |
| 4 <sup>th</sup>       | 11                     | 43                     | 7                 | 36                           | 90             | 37                       | 37, 100%              | 0, 0%                            |
| 5 <sup>th</sup>       | 9                      | 32                     | 5                 | 27                           | 60             | 16                       | 16, 100%              | 0, 0%                            |
| 6 <sup>th</sup>       | 11                     | 36                     | 6                 | 30                           | 60             | 17                       | 17, 100%              | 0, 0%                            |
| 7 <sup>th</sup>       | 14                     | 44                     | 6                 | 38                           | 60             | 22                       | 20, 91%               | 2, 9%                            |
| 8 <sup>th</sup>       | 15                     | 44                     | 6                 | 38                           | 60             | 23                       | 23, 100%              | 0, 0%                            |

**Number of comments**

The total number of comments made during the teleconference also varied. The total durations of the 2<sup>nd</sup>-4<sup>th</sup> teleconferences were 90 minutes (compared with 60 minutes for the other five teleconferences), and the total numbers of comments were higher during those teleconferences. The average numbers of comments made during 90-minute and 60-minute teleconferences were 44 and 20, respectively. During each teleconference, a significant difference was found in the percentage of comments made by experts and other participants. During the 1<sup>st</sup> and 2<sup>nd</sup> teleconferences, an average of 35% of the comments was made by the other participants. However, between the 2<sup>nd</sup> and 3<sup>rd</sup> teleconferences, there was a steep decrease (87%) in the percentage of comments made by other participants. During the 3<sup>rd</sup>-8<sup>th</sup> teleconferences, the average percentage of comments made by other participants was only 3% (i.e., most comments were made by the experts).

**Additional questionnaire**

Of the other participants, 40% (4, n=10) and 19% (3, n=16) had questions during the discussion phases of the 7<sup>th</sup> and 8<sup>th</sup> teleconferences, respectively (Figure 4). There was a 53% decrease in the proportion of participants with questions. The results showing the reasons why the participants did not ask questions during the discussion are shown in Figure 5. Of which, 75% (3, n=4) and 67% (2, n=3) answered that they did not ask questions because the discussion was concentrated between the experts during the 7<sup>th</sup> and 8<sup>th</sup> teleconferences, respectively.

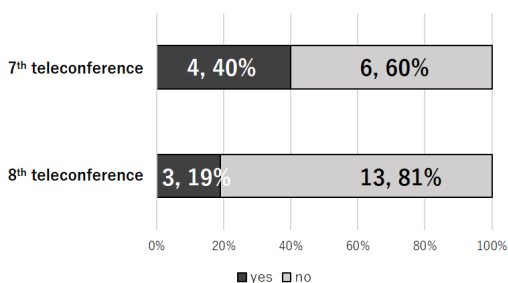


Figure 4- Proportions of participants who had questions during the discussion phase

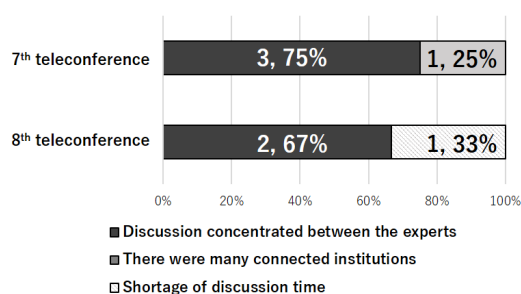


Figure 5- Reasons why the participants did not ask questions during the discussion phase

**Live polling**

The results concerning the participants' opinions toward the live polling are shown in Figure 6. Of all questionnaire respondents, 88% (15, n=17) stated that the live voting increased the quality of the discussion, and 76% (13, n=17) stated that participants were able to learn other participants' opinions, with 94% (16, n=17) finding them useful. Further, 71% (12, n=17) stated that the participants were able to grasp other participants' comprehension level, and 94% (16, n=17) stated the chair incorporated the participants' opinions into the discussion. Figure 7 shows an example of the live polling as it was carried out.

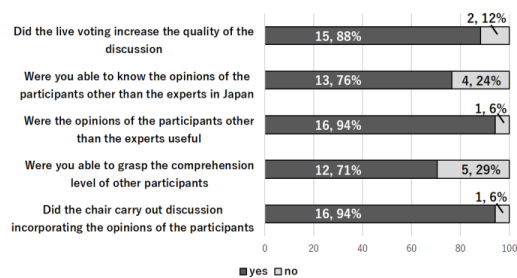


Figure 6- Opinions regarding the live polling

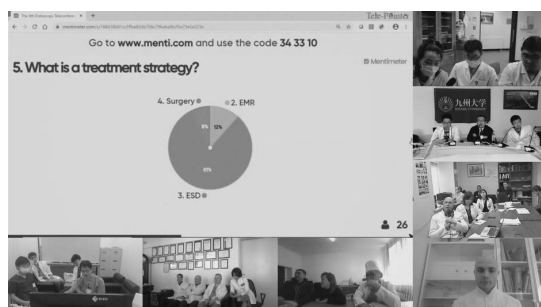


Figure 7- Example of live polling during the 8<sup>th</sup> teleconference

## Discussion

### Image and audio quality

Teleconferencing is an effective method of knowledge sharing with remote participants, but there are technical factors that affect its overall quality. Many studies have shown how image and audio related factors affect teleconference quality [3-4]. To maintain high-quality images and audio, we conducted thorough connection tests with all remotely connecting sites before the actual teleconference. The test connections assessed the quality of the images, audio, and network. To discuss ECG diagnosis in depth, transmission of high-quality endoscopy and pathological images are required so that the participants can properly recognize subtle changes of mucosal color or specific structures. To test the image quality, we displayed high-resolution medical images and checked whether the remote sites received them clearly and smoothly. Good audio quality is also important to conduct smooth conversations between all participants. For the audio tests, we checked whether the audio quality to and from the remote sites was clear, with no disturbing noises or loopback. Stable transmission is essential to maintain high-quality images and audio continuously throughout the teleconference. To test the network situation, we checked statistics such as those involving the receiving and sending data flow. If any technical issues arose during the teleconferences, they were addressed between engineers stationed at each remote site by communication via background chat systems, which did not interrupt the teleconference. Throughout the eight teleconferences, we were able to maintain high-quality image and audio transmission, thus technically enabling a high-quality teleconference. Therefore, technical factors did not affect the quality or progress of the teleconference in any way.

### Cause of differences in number of comments

As noted in the results (Table 1), there was a lack of balance in the percentages of comments made by the experts and other participants. After seeing that three consecutive teleconferences (the 4<sup>th</sup>–6<sup>th</sup> teleconferences) had 0% comments made by the other participants, we investigated whether the participants had questions during the discussion phase of the 7<sup>th</sup> teleconference, and if yes, why they did not ask their questions. Of the respondents, 40% (4, n=10) had questions but did not ask them during the discussion phase, and the majority (75%) stated that the reason was because the discussion was concentrated between the experts. The participants may have kept silent because the discussion between the experts contained much

meaningful information and hesitated to interrupt, which could have shortened the experts' discussion time. A major reason why participants do not actually speak up is that they are concerned about what others may think. For example, they may be intimidated about being humiliated for asking a question [8-9]. The participants may have also thought that their questions had significance only to themselves, but their questions can actually lead to informative answers from the experts that are useful to all participants, which the experts were anticipating and thus waiting for questions. Therefore, there may have been a gap between how the participants felt and what the experts wanted. Not knowing whether other participants had any questions may also be a reason. This may have changed if one participant asked a question and others followed. Therefore, including a way to give participants insight on other participants' thoughts during the discussion may have increased the number of comments from other participants.

Differences were found between the teleconferences during which the other participants made comments, such as an 87% decrease in the percentage of comments made by the other participants between the 2<sup>nd</sup> and 3<sup>rd</sup> teleconferences. During the 1<sup>st</sup> and 2<sup>nd</sup> teleconferences, the chair asked all remote sites for comments in an orderly fashion, but he did not do this from the 3<sup>rd</sup> teleconference. Therefore, how the chair organized the discussion phase of the teleconference influenced the percentage of comments made by the other participants. One simple solution to create an inviting atmosphere and engage participants in the discussion is to have the chair ask specific participants for questions when needed.

### How live polling can affect the discussion

Studies of audience response systems have concluded that live polling enables participants to respond to specific questions and is an effective measure to increase participants' interactivity and comprehend their understanding without requiring, for example, hand raising [10-11]. Many of the free comments within the questionnaire results from the 7<sup>th</sup> teleconference suggested adding live polling to future teleconferences. Therefore, we decided to add live polling to the 8<sup>th</sup> teleconference.

Although the percentage of comments made by other participants did not increase, 88% (15, n=17) answered that the quality of the discussion increased for the 8<sup>th</sup> teleconference. This shows a positive effect of adding live polling. Other results indicated how the live polling affected the participants' views. There was a 53% decrease in the percentage of participants with questions who did not ask them during the discussion phase. Further, 94% (16, n=17) stated that the chair incorporated the participants' opinions into the discussion. The percentage of participants with questions may have decreased because the chair conducted the discussion amongst the experts according to the participants' opinions, and thus covered what the majority of participants wanted to know. Furthermore, there was additional positive feedback about adding the live polling. Of the responding participants, 76% (13, n=17) and 94% (16, n=17) stated that participants were able to learn the other participants' opinions and found them useful, respectively. Additionally, 71% (12, n=17) stated that they were able to grasp other participants' comprehension levels. This shows that the participants were concerned about others' opinions and how well the other participants understood the discussion portion of the teleconference. The feedback provided by the live polling is an advantage not only for the other participants but also for the chair; this is because the chair can manage the discussion more easily knowing verbally silent participants' wants or needs without guessing their opinions.

There are many live polling systems available. Examples include Poll Everywhere (San Francisco, CA), Nearpod (Fort Lauderdale, FL), slido (Bratislava, Slovakia), and Mentimeter (Stockholm Sweden). These products all allow live polling with instant response reporting. These live polling systems are to be used in parallel with videoconferencing systems. There are some differences in what each system supports: the maximum audience size or number of polls per event may depend on the selected plan.

### Other features to increase participants' engagement

Some other technologies, such as chat and breakout rooms to further engage the participants in the discussion, may also be incorporated. Most videoconferencing systems, such as Zoom (San Jose, CA), CiscoWebex (San Jose, CA), Skype for Business (Redmond, WA), and Vidyo (Hackensack, NJ), have implemented a text-based chat function. The advantage of the chat function is that participants can ask questions using the chat function without interrupting the teleconference. However, some research has stated that it is a challenge for a meeting chair to monitor and respond to posted chat messages. Thus, it is recommended that a separate individual monitor the information in the chat and inform the chair of the contents [11]. A breakout room is a virtual space that is separated from the main teleconference room. This function is provided by Zoom and CiscoWebex and is effective for facilitating smaller group discussions. For example, the participants can be separated into smaller groups, and an expert can be assigned to a group for further discussion. Participants may feel easier and more confident in smaller sized groups, as fewer peers are listening [9]. The authors are planning to organize future teleconferences in which participants are advised to use the chat function to make comments or ask questions. A separate individual will be assigned to monitor the chat and give information to the chair.

### Limitations

This study had some limitations. As most of the participants who answer the questionnaires are fixed members of the teleconferences, the results may reflect individual bias. Furthermore, the number of respondents to the questionnaire is limited. Only one or two participants from each connecting institution answered the questionnaire. Therefore, we need to contrive ways to survey more participants from each connecting institution when more than two participants join the teleconference. One method could be obtaining cooperation from the participants who always answer the questionnaires to recruit the other meeting participants to do the same. Additionally, because the additional question investigating whether the participants did not ask a question during the discussion phase was only administered two times, and live polling was only added to the teleconference once, we need to conduct more teleconferences with these factors and gather more data in the future.

### Conclusion

We found that many participants did not ask questions during the teleconferences because the discussion was concentrated between the experts. We showed that implementing live polling into the teleconference improved the quality of the discussion phase.

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