Original Article

Comparison between Online and On-Site Pre-Anesthesia Evaluation in Patients Undergoing Colonoscopy: A Randomized Controlled Trial

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Background: The pre-anesthesia evaluation plays a vital role to determine anesthetic risk and to plan the anesthetic technique to reduce the morbidity and mortality associated with surgery.

Objective: To compare online and on-site groups for pre-anesthesia evaluation in patients undergoing colonoscopy at Surin Hospital, a tertiary care hospital in Thailand.

Materials and Methods: Seventy-four patients scheduled for colonoscopy and consulted with the Surin Pre-Anesthesia Clinic (SuPAC), were randomized by a computer program and sealed envelope. Thirty-seven samples were assigned to online as the experimental group, and thirty-seven samples were assigned to on-site as the control group. The primary outcome was adequate pre-anesthesia evaluation. The authors measured pre-anesthesia checklist score to evaluate knowledge, awareness, and behavior of patients as well as comprehensive and accurate assessment before anesthesia, using 18 points. Three experts had validated these instruments. The index of item objective congruence (IOC) was 1.0, a non-inferiority test found $p<0.001$, and the Guttman Split-Half coefficient for reliability as internal consistency was 0.725. Secondary outcomes included the smoothness of anesthesia, incidence of postponing or canceling procedure due to inadequate preparation, complications, patient anxiety using the Thai Hospital Anxiety and Depression Scale, Thai HADS, and patient satisfaction.

Results: Sixty-six patients completed the present study with 34 on-site and 32 online, with no differences in demographics data or anxiety level either before or after pre-anesthesia assessment between the two groups. The online group was significantly non-inferior pre-anesthesia evaluation than the on-site group (0.69, 95% CI 0.07 to 1.31 $p=0.033$, non-inferiority limit=1.0). Furthermore, the online group had a better pre-anesthesia checklist score than the on-site group at 17 (16, 18) and 16 (15.75, 17.25) points, respectively, due to the online group having more knowledge and understanding of the role of an anesthesiologist. All patients underwent a planned colonoscopy without major complications. There was no difference in patient satisfaction between groups.

Conclusion: The online pre-anesthesia evaluation in Thai patients was non-inferior to the on-site evaluation, suitable in the New Normal era to allow social distancing, safe patient care, reduce the inconvenience, and reduce the cost to patients.

Keywords: Pre-anesthesia evaluation; Pre-anesthesia preparation; Preoperative assessment; Online; Video conference

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Pre-anesthesia evaluation and preparation (PAE) help determine anesthetic risk, perioperative complications and management as well as the reduction of morbidity and mortality associated with surgery and non-surgical procedures[1]. During PAE, it is the anesthesiologists' responsibility to emphasize patient safety, minimize delays, and cancel surgery. However, lack of knowledge about anesthesiologists' roles and the relevance of appropriate pre-anesthesia assessment may affect patients' cooperation[2,3]. Apart from producing greater satisfaction[4,5], patient education may lower anxiety levels, analgesic requirements, and post-anesthesia complication. The current COVID-19 pandemic forced clinicians and healthcare systems to embrace flexibility in administration to prevent healthcare system overburdening, postponing elective and non-urgent medical procedures. Interestingly, primary health care currently includes virtual appointment via telemedicine. In a study by Fagherazzi et al, digital tools effectively supported institutions by

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facilitating widespread distribution of information, creating virtual venues for meetings and providing telemedicine visits for patients[6]. De Biase et al leveraged it in the neurosurgery department to provide outpatient care[7]. Additionally, countries recommended telemedicine for preoperative patient assessment during the coronavirus (COVID-19) pandemic[8-11]. However, telemedicine, a new technology, has yet to become familiar among Thai patients and should be tested for suitability and safety. The objectives of the present study were to compare online and on-site groups for pre-anesthesia evaluation in patients undergoing colonoscopy at Surin Hospital, a tertiary care hospital in Thailand.

Materials and Methods

The present study was a prospective interventional study approved by the Surin Hospital Human Research Ethics Committee (no.11/2564) and registered at the Thai Clinical Trial Registry (TCTR20210303008). The patients scheduled for colonoscopy would be sent to Surin Pre-Anesthesia Clinic (SuPAC) on the same day. Adults, 18 to 90 years old, who cooperated in communication during the assessment were considered for participation. Patients who did not have a smartphone or internet access, the American Society of Anesthesiologists (ASA) physical status (PS) 4 or higher, or refused to participate were excluded from the present study. The remaining patients were randomly assigned by a computer program and sealed envelopes at the time consent to face-to-face as on-site group with 37 participants or video conferencing as online group, also with 37 participants. Patients provided written informed consents for participation. PAE is performed by anesthetist or anesthesiologist under standardized procedures[12], with documentation in the pre-anesthesia record related to history taking, physical examination, airway assessment, along with testing, medical consultation for patient-specific factors, and Thai Hospital Anxiety and Depression Scale (HADS). The risk of undergoing surgery was determined, and a perioperative plan was formed, and discussed with patients and their families. Certain lifestyle modifications were also advised, like cessation of smoking, cessation of drinking, or personal prevention of COVID-19. The patients randomized to on-site underwent PAE to queue in the SuPAC, per the authors' practice. The patients randomized online had a separate appointment for PAE whenever it was convenient but all of them underwent a heart and lung examination before leaving SuPAC. Educational tools such as leaflets and videos were provided in SuPAC waiting areas or attached online. They were the same in both groups.

For the present study, LINE Official Account (Line OA) was used for communication as it was one of the most popular applications in Thailand. Line OA application could send general information, request video conferencing, and create a rich menu for attaching quizzes, leaflets, and videos. SuPAC staff were trained on using this App.

Outcome measured by questionnaires. Thirteen topics of anesthesia checklist, with 22 points, were adapted from the ASA and the Royal College of Anesthesiologists of Thailand[13,14]. The primary outcome was adequate pre-anesthesia evaluation by evaluate knowledge, awareness, and behavior of patients as well as comprehensive and accurate assessment before anesthesia with 18 points. Secondary outcomes included the smoothness of anesthesia, incidence of postponing or canceling procedure due to inadequate preparation, and complications with four points. Patient anxiety with Thai HADS[15] and patient satisfaction were also measured. Anesthesia management was at the discretion of the anesthesiologist assigned to care for the patient. Anesthetists were blinded to group assignment and evaluated all patients on the day of surgery, reviewing the medical history, performing cardiopulmonary and airway examinations, and Thai HADS. They also assessed completeness and accuracy of PAE, smoothness of anesthesia, perioperative problems, and complications.

Patient satisfaction using a 5-point Likert scale ranged from 0 to 4 where 0 means very dissatisfied and 4 means very satisfied. More research details and instructions are available in the Supplemental Appendix, available online from the attached link https://dlink.me/EKtYz.

Statistical analysis

Based on a pilot study of 30 on-site, control, subjects, the average assessment score was 16.8, with a standard deviation of 1.47. The sample size was calculated using the nQuery Advisor program for comparing the mean of two groups, non-inferiority trial. With a significance level of 0.05, non-inferiority limit of 1, standard deviation of 1.5 with power set at 80%, a sample size of 29 samples was required per group and reserved for a 20% drop out, so there must be 37 samples per group. The anesthesia checklist has been validated by three experts and item objective congruence (IOC) was 1.0. A non-inferiority test found a p-value less than 0.001 and the Guttman Split-

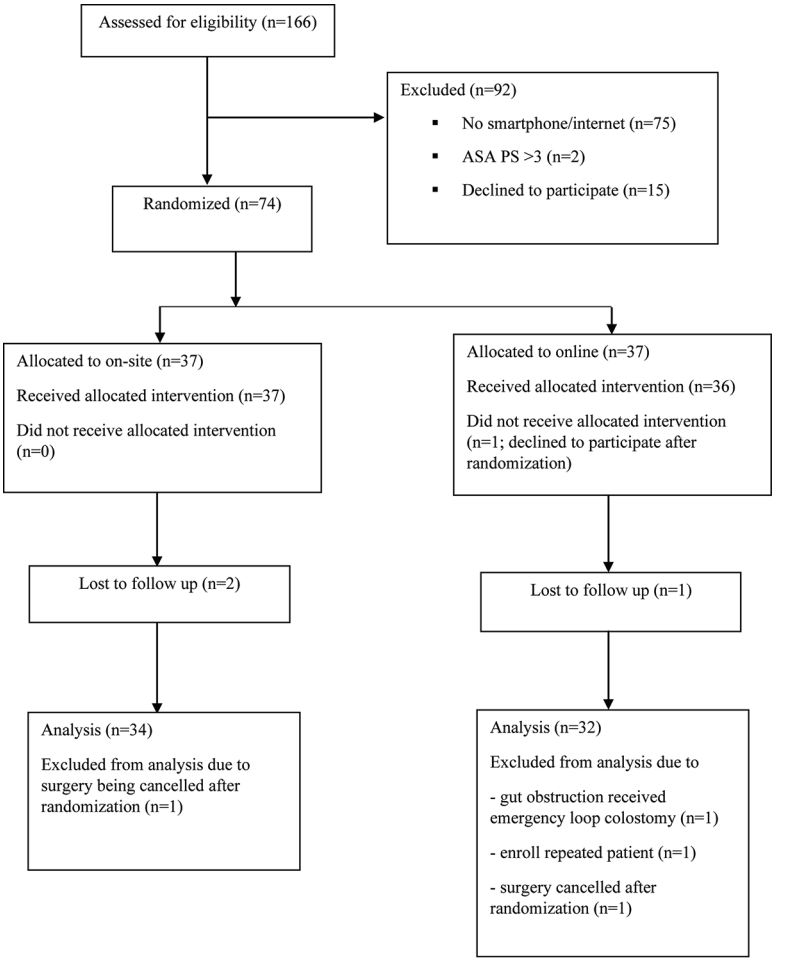

Figure 1. Consort diagram.

Half coefficient for reliability as internal consistency was 0.725. Data analyses were performed with PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL, USA), and threshold a p-value of less than 0.05 was considered significant. Descriptive statistics were used to summarize demographic characteristics such as age, gender, education, indication for colonoscopy, ASA classification, and underlying disease. Quantitative data were presented as mean ± standard deviation, or median (percentile 25, percentile 75), and qualitative data were presented as frequency (percent). Non-inferiority test using the equal-variance t-statistic was used to compare the mean of anesthesia checklist score between the on-site and the online group. To evaluate the difference in quantitative variables with and without normal distribution between the two groups, independent t-test and Mann-Whitney U test were applied, respectively. Pearson's chi-square test or Fisher exact test was used to test the difference in qualitative variables.

Results

Between March 2, 2021 and August 31, 2021, 166 patients enrolled in the present study. Of those, 92 patients were excluded (55.42%) due to no smartphone or internet (n=75), ASA PS 4 or higher (n=2), or declined to participate (n=15). This left 74 patients to be randomized. After randomization, one patient refused to participate, three patients were lost follow up, two patients canceled colonoscopy due to COVID-19 policy, one patient underwent emergency loop colostomy, and one enroll repeated patient. Those mentioned above were excluded from the analysis (Figure 1). Intergroup comparisons of the 66 patients analyzed are summarized in Table 1. Forty-four percent of all patients were 61 to 80 years of age. There were no differences in demographics data.

Table 1. Baseline characteristics of study

Clinical characteristics	On-site (n=34)	Online (n=32)	p-value
Age (year); mean±SD	56.85±13.93	58.13±13.97	0.712
Patients age (years); n (%)			0.654
>60	13 (38.2)	16 (50)	
41 to 60	16 (47.1)	13 (40.6)	
≤40	5 (14.7)	3 (9.4)	
Sex; n (%)			
Male	15 (44.1)	15 (46.9)	0.822
Female	19 (55.9)	17 (53.1)	
Education; n (%)			0.732
Primary school	25 (73.5)	21 (65.6)	
High school	2 (5.9)	4 (12.5)	
Bachelor or higher	7 (20.6)	7 (21.9)	
Indication for colonoscopy; n (%)			
Abnormal CRC screening	9 (26.5)	6 (18.8)	0.454
Abdominal pain	4 (11.8)	2 (6.3)	0.673
Bowel habit change	11 (32.4)	9 (28.1)	0.709
LGIH	4 (11.8)	8 (25.0)	0.164
Surveillance	5 (14.7)	6 (18.8)	0.660
Other	1 (2.9)	1 (3.1)	1.000
ASA PS; n (%)			0.508
1	4 (11.8)	4 (12.5)	
2	15 (44.1)	18 (56.3)	
3	15 (44.1)	10 (31.3)	
Distance* (km); median (P25, P75)	30.0 (11.5, 60.25)	38.5 (13.25, 70)	0.445
Time spent** (minutes); median (P25, P75)	450 (315, 517.5)	390 (303.75, 532.5)	0.602

SD=standard deviation; CRC=colorectal cancer; LGIH=lower gastro-intestinal hemorrhage; ASA PS=American Society of Anesthesiologists physical status

* Distance from the home to Surin Hospital, ** The average time of visit from leaving home to returning home

Table 2. Factor before and after pre-anesthesia evaluation & preparation

Factor	On-site (n=34)	Online (n=32)	p-value
HADS* before intervention; median (P25, P75)	7 (4, 8.25)	6 (4, 7)	0.159
HADS* after intervention; median (P25, P75)	5 (2, 7)	5 (2.25, 6)	0.816
HADS change; median (P25, P75)	2 (–0.25, 4.25)	1 (0, 2)	0.204
SBP change**; mean±SD	5.27±15.66	2.75±13.39	0.487
DBP change***; mean±SD	0.24±11.44	–1.66±10.88	0.494

HADS=Hospital Anxiety and Depression Scale; SBP=systolic blood pressure; DBP=diastolic blood pressure; SD=standard deviation

* Three HADS cut-point scores reflect levels of symptom severity: nonanxious (0 to 7 scores), doubtful (8 to 10 scores), and anxious (>10)

** SBP change = SBP at SuPAC – SBP at preoperative room

*** DBP change = DBP at SuPAC – DBP at preoperative room

Thai HADS score and blood pressure (BP) before and after pre-anesthetic evaluation showed no significant difference between the two groups (Table 2). The median total assessment time of online group was statistically significantly being less than the on-site group at 24.16 versus 30 minutes. In addition, the online group had a better score on pre-anesthesia checklist than the on-site group at 17 (16, 18) versus 16 (15.75, 17.25), (p=0.033), as the online group had a better understanding of the role of anesthesiologist (p=0.049). While other knowledge such as anesthesia plan, self-care preparation, medication, food preparation, and laxatives in the online group were slightly better than the on-site group, they were not statistically significant. Heart and lung examinations on the day of colonoscopy

Table 3. Outcomes

Factor	On-site (n=34)	Online (n=32)	p-value
Total assessment time* (minutes); median (P25, P75)	30 (30,40)	24.16 (20.79, 30.83)	0.001
Anesthesia check list; median (P25, P75)	16 (15.75, 17.25)	17 (16, 18)	0.033
Patient understands the anesthetist role; n (%)	13 (38.2)	20 (62.5)	0.049
Patient understands the importance of anesthesia preparation; n (%)	15 (44.1)	20 (62.5)	0.135
Patient understands the anesthesia plan; n (%)	17 (50.0)	20 (62.5)	0.307
OSA prediction; n (%)	32 (94.1)	34 (100)	0.493
Proper medication; n (%)	33 (97.1)	34 (100)	1.000
Patient understands the precaution after anesthesia; n (%)	10 (29.4)	11 (34.4)	0.665
Proper food for bowel preparation; n (%)	29 (85.3)	29 (90.6)	0.710
Take laxative according to the doctor order; n (%)	28 (82.4)	31 (96.9)	0.106
Smooth anesthesia**; n (%)	32 (94.1)	31 (96.9)	1.000
Patient wake up and cooperate after anesthesia; n (%)	34 (100)	31 (96.9)	0.485

OSA=obstructive sleep apnea

* Total assessment time (total duration for PAE) on-site group: time spent in the SuPAC includes video watching online group = time spent in the SuPAC + time spent online

** Smooth anesthesia is defined as rapid and smooth during induction, maintenance, emergence, without side effects such as desaturation, hypotension, nausea, vomiting, and shivering

Table 4. Satisfaction

Factor	On-site (n=34); n (%)	Online (n=32); n (%)	p-value
SuPAC clinic			0.227
Satisfied	12 (35.3)	16 (50.0)	
Very satisfied	22 (64.7)	16 (50.0)	
Tools equipment			0.964
Satisfied	20 (58.8)	19 (59.4)	
Very satisfied	14 (41.2)	13 (40.6)	
Online option			NA
Neutral	-	1 (3.1)	
Satisfied	-	8 (25.0)	
Very satisfied	-	23 (71.9)	
During colonoscopy			0.880
Satisfied	9 (26.5)	9 (28.1)	
Very satisfied	25 (73.5)	23 (71.9)	
Post anesthesia			0.873
Satisfied	8 (23.5)	7 (21.9)	
Very satisfied	26 (76.5)	25 (78.1)	

NA=not applicable

were concordant with findings documented from SuPAC. Overall, pre-anesthesia evaluation and medical optimization were adequate. All patients underwent the planned colonoscopy. No patients delayed or cancelled the procedure due to inadequate preparation. The anesthesia during colonoscopy was smooth. Hypotension, with BP of less than 90/60, was observed in two cases in the on-site group (5.9%) and one case in the online group (3.1%), with no difference (p=1.000). The complication was mild and occurred shortly after stopping propofol (Table 3).

The patient satisfaction questionnaire found that the satisfaction scores were high for both groups (p-value at SUPAC, OR, PACU was 0.227, 0.880, 0.873, respectively) (Table 4). The satisfaction at the SuPAC was higher in the on-site patients than among the online patients.

Discussion

Telemedicine has been studied and contributed for almost thirty years. Similar to the prior studies, the present study supports the potential for online pre-anesthesia assessment to provide the information necessary for safe anesthesia care while reducing the inconvenience and cost of the patients[16], saving time and money without cancellation or delay of surgery[1]. This role was reemphasized and developed rapidly during the pandemic of COVID-19 as an effective tool for patient care allowing healthcare professionals to communicate more with the patients, keep social distancing, and achieve high patient satisfaction[6,8,9]. Physical examination is a critical component of PAE assessment and risk planning but may be limited in online assessment. Heart and lung examinations were performed with an electronic stethoscope in the previous study[16,17] but is not yet available at SuPAC. However, this is not a significant limitation because all the patients had cardiopulmonary examinations at SuPAC, concordant with the date of colonoscopy. A pilot study of Kavya et al supported telemedicine

images as a reliable tool for identifying airway difficulties. However, Mallampati and neck extension assessments have limitations when viewing still images[18]. The present study used video conferencing in airway examinations for dynamic assessment similar to De Biase et al, which provided outpatient care for neurosurgical patients during the COVID-19 outbreak[7].

Overall characteristics of the patients in both groups were not different in terms of age, gender, education, indication for colonoscopy, ASA classification, underlying disease, distance from home to hospital, time spent per visit, and Thai HADS score.

Although the mean total assessment time of the online group was statistically less than the on-site group at 24.16 and 30 minutes, respectively, there was no clinical difference. Because patients and their families spent hours, averaging 6 hours 49 minutes ± 2 hours 13 minutes, in each visit, saving 5 to 15 minutes will not make any difference. The online group was significantly non-inferior pre-anesthesia evaluation than the on-site group (p=0.033). Furthermore, the online group had a better pre-anesthesia checklist score than the on-site group at 17 (16, 18) and 16 (15.75, 17.25) points, respectively. The online subjects can read information or watch videos at a convenient time and can be repeat at any time, or leave a question in Line OA, so there is a greater chance of understanding than the on-site groups. Furthermore, the SuPAC staff who have scheduled appointments to assess and educate did not have time constraints, thus the patient was fully supervised.

The online process is more complicated to set up than the on-site. However, patients had no communication problems and reported high satisfaction. Patient satisfaction at the SuPAC reported on-site was 64.7% very satisfied, while only 50% online, in contrast to expectation that patients who were served earlier would be more satisfied. The authors assumed the online group were not advised to alleviate any anxiety. Although this feedback was not statistically different, it warned that SuPAC staff must be vigilant in alleviating concerns from the first visit. The overall satisfaction of the on-site and online groups were equal, similar to Fishman et al[19]. This is also an interesting issue. Satisfaction was similar despite patients or their families whose work would have lost at least half a day with the potential lost income and lost productivity and the additional potential costs related to travel and childcare, which may be significantly increased for patients living in rural areas. The authors postulated that half of the subjects were older, unfamiliar with new technology and required relatives to communicate. So, they may prefer on-site services. As a result, both groups had similar satisfaction.

Limitations of the present study were SuPAC online uses Line OA, which is not allowed by the Electronic Transactions Act or related laws. Therefore, privacy and confidentiality concerns persist with the risk of data loss or hacking. There should be further research and development of standardized telemedicine systems in Thailand. Due to small number of the patients in the present study, there was no cancellation or postponement of the surgery. Cancellation or postponement might potentially be observed if more participants were recruited, or the study was extended to patients from another department. Further prospective trials would be warranted with more patients and more departments.

Conclusion

The online pre-anesthesia evaluation in Thai patients was non-inferior to the on-site evaluation, suitable in the New Normal era to allow social distancing, safe patient care, reducing the inconvenience and cost to the patients. Online or telemedicine does not replace conventional medical practices but constitutes a response to the challenges and limitations during the COVID-19 pandemic. It must be based on a medical project and needs of the population of a territory and of health professionals.

What is already known on this topic?

Online pre-anesthesia evaluation provides the information necessary for safe anesthetic care while reducing the inconvenience, hospital costs, and the patient's cost.

What this study adds?

The online pre-anesthesia evaluation in Thai patients was non-inferior to the on-site evaluation, suitable in the New Normal era during the COVID-19 pandemic.

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Conflicts of interest

The authors declare no conflict of interest.

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