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ORIGINAL SCIENTIFIC REPORT

A National Evaluation of Surgeon Experiences in Telemedicine for the Care of Hernia and Abdominal Core Health Patients

Vahagn C. Nikolian[1] · Mudassir Akhter[1] · Emaad J. Iqbal[2] · Thomas Sutton[1] · Ashraf Samhan[1] · Sean B. Orenstein[1] · Michael J. Rosen[3] · Benjamin K. Poulose[4]

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Abstract

Background Surgeons are increasingly utilizing telemedicine to provide perioperative services to patients. Safety, satisfaction, and feasibility of these programs in general populations have been established, but it is unclear how telemedicine can be integrated into subspecialty care. We report results of a national survey related to telehealth practices among members of the Abdominal Core Health Quality Collaborative (ACHQC).

Methods Survey responses were analyzed to determine current strategies in telemedicine utilization. Surgeon preferences, perceptions of validity, and identified barriers to implementation of telemedicine were assessed.

Results Forty surgeons within the ACHQC responded, with 90% of respondents reporting use of telemedicine to deliver perioperative care to patients with hernias and abdominal core health concerns. Surgeons appeared to be more comfortable managing preoperative patients with image-confirmed diagnoses of hernias. Surgeons were universally more comfortable delivering postoperative care via telemedicine. Connectivity, patient engagement, and reimbursement were identified as potential barriers to expansion of telemedicine. Seventy-eight percent of respondents reported that they would increase telemedicine utilization if current regulations were maintained in the future.

Conclusions This study found that hernia specialists are utilizing telemedicine at a higher rate than before the COVID-19 pandemic, with surgeons reporting interest in continued use of this modality beyond the pandemic. These findings suggest that future work in telemedicine optimization may improve the quality of care that can be delivered to patients with abdominal core health concerns.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic has disrupted well-established practice models in healthcare [1]. In an attempt to preserve medical resources and reduce disease spread, hospital systems developed innovative workflows to allow for delivery of care, with an increased focus on the utilization of telemedicine and virtual care [2, 3]. Though these technologies have been available for decades, they have been underutilized secondary to perceived barriers related to lack of direct patient contact, limitations in performing an adequate physical examination, and challenging reimbursement models [4]. Evidence suggests that telemedicine approaches can be accurate [5],

✉ Vahagn C. Nikolian
nikolian@ohsu.edu

[1] Department of Surgery, Division of Gastrointestinal and General Surgery, Oregon Health & Science University, Mail Code L 233A, 3181 SW Sam Jackson Park Road, Portland, OR 97239, USA

[2] Department of Surgery, Columbia University Irving Medical Center, New York, NY, USA

[3] Center for Abdominal Core Health, Cleveland Clinic Foundation, Cleveland, OH, USA

[4] Center for Abdominal Core Health, Ohio State University, Columbus, OH, USA

cost-effective [6], safe [7], and associated with appropriate patient satisfaction [8].

For surgeons, the pandemic has forced many to significantly increase telemedicine utilization for a variety of patient interactions. This rapid implementation process has given the surgical community a snapshot of the current status of telemedicine evaluations. Though many institutions and stakeholders are enthusiastic about telemedicine, little is known about the role that this technology can have in specific surgical populations. The COVID-19 pandemic has given surgeons an opportunity to assess what patient populations may be best served with telemedicine platforms and which elements of telemedicine technology require further optimization.

Hernia repair is one of the most common operations performed in the USA [9, 10]. Given the rapid increase in telemedicine utilization, it is necessary to evaluate provider experiences to guide future strategies in implementation and expansion of telemedicine for specific patient populations. To our knowledge, no studies have reviewed surgeon impressions of the utility of telemedicine evaluations for hernias and abdominal core health. In this study, we sought to assess utilization of telemedicine by surgeons within the Abdominal Core Health Quality Collaborative (ACHQC) for the management of patients with hernias and abdominal core health concerns.

Material and methods

In this survey-based study, a 27-question web-based survey (SurveyMonkey^{TM}; Portland, OR, USA) was developed to assess surgeon telehealth utilization during the COVID-19 pandemic. (**Supplementary 1**) The study population included all active members of the ACHQC, a non-profit organization with aims to improve outcomes and value in abdominal core and hernia patient care through data collection, analysis, and collaborative learning. The survey items evaluated current practices, assessed perceived obstacles and enablers of telemedicine implementation, and reviewed surgeon opinion of case types that were well suited for digital-based consultation. The survey collected quantitative and qualitative data. The anonymous, electronic questionnaire was sent to the 237 active members of the ACHQC in May 2020. The survey took an estimated 10 min to complete. Reminders were sent two weeks following the initial email. All survey responses were de-identified.

Basic surgeon demographic information was obtained using the survey. We sought to understand how surgeons utilized telemedicine during the COVID-19 Pandemic. Survey questions focused on surgeon experience, prior exposure to telemedicine, the impact of COVID-19 on clinic volume, and the modalities used to perform digital patient care. We focused on understanding factors specific to hernia care, along with responses about personal experiences taking care of patient with a variety of commonly encountered conditions. Surgeons were asked about their comfort with evaluating patients in the pre- and postoperative period. Questions related to perceived barriers were addressed to inform future optimization. The results were detailed from the compiled outcomes. Chi-squared testing was utilized to evaluate survey answers by respondent demographic groups; the Yates correction for continuity was not utilized when calculating Chi-squared *P* values. Data were analyzed using SPSS version 27 (IBM Corp, Armonk, NY). This research project was approved by Oregon Health & Science University's Institutional Review Board.

Results

Between May 21, 2020 and June 7, 2020, the survey was distributed to 237 active members of the ACHQC, and 40 responses were recorded (16.9% response rate). Demographics of respondents are reviewed and summarized in Table 1. The majority of surgeons reported at least 8 years of practice as high-volume hernia surgeons (77.5%) and worked in academic (45%) or academically affiliated practice environments (32.5%). All (100%) surgeons reported that COVID-19 impacted their in-person clinic volume, with the majority (65%) reporting that they were required to completely suspend in-person clinic evaluations.

Telemedicine utilization prior to pandemic

Most surgeons (82.5%) reported that they had never utilized telemedicine prior to the pandemic. Similarly, 85% reported that they were unaware telemedicine modalities existing at their institution. Volume of telemedicine encounters was sparse, with only two (5%) surgeons reporting more than one telemedicine evaluation per month in the pre-pandemic period. Of the seven pre-pandemic telemedicine utilizers, services provided were centered around evaluation of established patients (57%) and immediate postoperative care (86%). Only three surgeons (7.5%) reported using telemedicine for new patient encounters. No clear trends were established for billing of patient encounters in the pre-pandemic period.

Telemedicine utilization during the pandemic

Surgeons increased telemedicine utilization during the COVID-19 pandemic, with 90% of surgeon respondents

Table 1 Demographics of respondents ($n = 40$)

Surgeon-reported characteristics	Total (%)
Training background	
Board certified general surgeon with no fellowship training	19 (47.5%)
Board certified general surgeon with fellowship training in minimally invasive surgery (MIS)	19 (47.5%)
Board certified general surgeon with other fellowship training	2 (5%)
Number of years in practice (years)	
1–3	4 (10%)
4–7	5 (12.5%)
8–15	12 (30%)
> 15	19 (47.5%)
Clinical practice environment	
Academic	18 (45%)
Academic affiliated	13 (32.5%)
Private practice	9 (22.5%)
Surgeon reported proportion of cases that are hernia related	
< 25%	6 (15%)
25–50%	7 (17.5%)
51–75%	13 (32.5%)
> 75%	14 (35%)

reporting use of these services for patient care compared to 17.5% pre-pandemic ($P < 0.001$, Table 2). A variety of applications were used by surgeons to connect with patients, with Zoom (San Jose, CA) being the most utilized (50% of respondents) and most preferred (31% of respondents). Frequency of telemedicine evaluations increased during the pandemic, with 69% of surgeons reporting more than 10 digital patient encounters per month. In contrast to the pre-pandemic period, services spanned the full spectrum of perioperative care, with nearly all respondents reporting use of telemedicine for established (94%), new patient encounters (81%), and postoperative care (94%). The majority (83%) of surgeons used time-based billing for encounters. Notably, patterns of telemedicine services utilization differed by respondent demographics: 95% ($n = 17$) of MIS-fellowship-trained respondents reported using telehealth for new patient encounters, compared to 66% ($n = 12$) of non-MIS-trained respondents ($P = 0.035$); identical results were noted for respondents in academic compared to private practice settings. Ninety-five percent ($n = 19$) of respondents in practice for < 15 years reported utilization of telehealth for new patient evaluations, compared to 62.5% ($n = 10$) of respondents in practice for > 15 years ($P = 0.014$). There were no significant differences in telehealth utilization for established or postoperative visits by practice duration, practice setting, or fellowship ($P > 0.1$ for all); proportion of clinical volume constituted by abdominal core health was not associated with utilization of telehealth for new, established, or postoperative patients.

Hernia care rendered using telemedicine services

We assessed hernia-specific care that surgeons provided using telemedicine. (Table 3) Seventy percent of surgeons reported using telemedicine in the pre- and postoperative setting. Surgeons felt comfortable evaluating the following diagnoses virtually: primary inguinal hernia (79% of respondents), primary ventral (75% of respondents), and incisional hernias without loss of domain (68% of respondents). Diagnoses-related enterocutaneous fistulae (11% of respondents), incisional hernias with loss of domain (25% of respondents), and groin pain (29% of respondents) were less commonly managed using telemedicine strategies.

The most common case types that were evaluated in the postoperative setting included minimally invasive surgical (MIS) repair of groin hernias (82%), MIS repair of primary ventral hernias (75%), and open repair of groin hernias (61%). Respondents in academic practice settings were less likely to utilize telemedicine services postoperatively for patients undergoing surgery for groin pain (0%, $n = 0$) than private practitioners (33%, $n = 5$; $P = 0.01$), with similar results for respondents that were MIS-fellowship trained (0% versus 36%; $P = 0.006$). Respondents with MIS-fellowship training (39%, $n = 7$) were non-significantly less likely to report utilizing telemedicine services for the

Table 2 Surgeon reported telemedicine utilization during the pandemic

Responses (Total 36)	*n* (%)
Platforms used for video based	
Zoom	18 (50%)
EMR-based application	9 (25%)
Doxy.me	9 (25%)
Doximity	8 (22%)
Facetime	8 (22%)
Other*	9 (25%)
Preferred platform	
Zoom	11 (31%)
Doximity	7 (19%)
EMR-based application	5 (14%)
Doxy.me	4 (11%)
Other **	4 (11%)
Estimated video-based evaluation performed per month	
< 1	3 (8%)
1–10	8 (22%)
11–20	12 (33%)
> 20	13 (36%)
Services provided to patients	
Evaluation of new patients	29 (81%)
Immediate postoperative care	34 (94%)
Evaluation of established patients	34 (94%)
Billing methods utilized	
Time-based billing	31 (83%)
Bundled payments related to operation	11 (28%)
No billing for telephone encounter	8 (22%)

*Other: Updocs (2), Amwell (2), Android (1), E-Visit (1), Duo (1), Webex (1), Vidyo (1)

**No other choices offered/nothing to compare (3), Vidyo (1)

postoperative evaluation of open inguinal hernia repair versus non-fellowship-trained respondents (71%, $n = 10$; $P = 0.067$). There were no other trends in utilizing telemedicine postoperatively for open/MIS repair of inguinal hernias, surgery for groin pain, open/MIS repair of epigastric/umbilical/flank hernias, or incisional hernias with or without loss of domain by practice setting, duration, fellowship training, or practice volume ($P > 0.2$ for all).

Perceptions regarding the future of telemedicine

We next assessed surgeon perceptions on the viability of telemedicine evaluations in a variety of case scenarios and compared them by respondent demographics (Table 4). The majority of surgeons believed that video-based evaluation was a viable option for patients presenting with imaging-confirmed diagnoses of primary ventral (81%), inguinal (72%), and incisional/recurrent hernias (64%). Surgeons felt that these suspected diagnoses without imaging were less viable for preoperative telehealth evaluation (39%, 33%, and 26%, respectively). A minority of surgeons believed groin pain (6%) and enterocutaneous fistulae (23%) could be appropriately managed with a preoperative telehealth evaluation. Almost universally, surgeons felt that telehealth evaluations were more viable in the postoperative setting. Surgeons believed in the viability of video-based evaluation of postoperative patients following MIS groin hernia repair (92%), open repair of groin hernias (89%), and MIS repair of ventral and incisional hernias without myofascial release (81%). The majority (92%) of surgeons responded that video-based postoperative care was efficient.

There were significant differences in the aforementioned metrics by practice setting, number of years in practice, and MIS-fellowship training (Table 4). Broadly, respondents in practice for < 15 years, those practicing in an academic setting, and those with MIS-fellowship training were more likely to perceive telehealth as a viable platform for both preoperative and postoperative care across the spectrum of abdominal core health operations and diagnoses. Respondent perceptions on the pre- and postoperative use of telehealth services did not significantly differ by clinical practice volume, except for in the evaluation of patients with clinically diagnosed incisional or recurrent hernias (0% vs 37.5% perceiving utility for respondents with $<$ 50% vs $>$ 50% practice volume composed of abdominal core health cases; $P = 0.014$), and in the postoperative evaluation of open/MIS repair of ventral/incisional hernias with myofascial release (25% vs 66.7% for respondents with $< 50\%$ vs $> 50\%$ practice volume composed of abdominal core health cases; $P = 0.018$). Respondents were not significantly different in their perceived trajectory of telehealth use after the pandemic, regardless of practice setting, practice duration, clinical volume, or MIS training (all $P > 0.1$).

Perceived barriers related to telemedicine expansion

The final portion of the survey focused on assessing the perceived barriers associated with telemedicine expansion. The findings of these results are presented in Table 5**.** Though most surgeons found the barriers queried to be minor or moderate, a higher proportion of respondents felt that connectivity (31%), patient engagement (28%), and cost/reimbursement (22%) were significant barriers to effective implementation of telemedicine evaluations. Staffing, lack of medical records, provider/institutional resistance, and scalability were considered to be minor and/or moderate barriers to implementation by more than 90% of respondents. Overall, 78% of surgeons reported that they

Table 3 Hernia care rendered using telemedicine

Responses (Total 28)	*n* (%)
Patient population evaluated preoperatively	
Primary Inguinal Hernias	22 (79%)
Primary Ventral Hernias	21 (75%)
Incisional Hernias without loss of domain	19 (68%)
Recurrent Inguinal Hernias	11 (39%)
Groin Pain	8 (29%)
Incisional Hernias with loss of domain	7 (25%)
Enterocutaneous fistula	3 (11%)
Patient population evaluated postoperatively	
MIS repair of groin hernias	23 (82%)
MIS repair of primary ventral hernias	21 (75%)
Open repair of groin hernias	17 (61%)
Open repair of incisional hernias without loss of domain	16 (57%)
Open repair of primary ventral hernias	14 (50%)
Open repair of incisional hernia with loss of domain	9 (32%)
Surgery for groin pain	5 (18%)

would increase telemedicine utilization if the emergency regulatory measures were to be maintained in the post-pandemic period. There were no significant differences in perceived barriers to telemedicine expansion between respondent practice settings, practice duration, fellowship training, or clinical volume of abdominal core health cases ($P > 0.1$ for all).

Discussion

In this study, the majority of respondents utilized telemedicine approaches during the COVID-19 pandemic, despite few reporting prior experience. Surgeons reported telemedicine's efficacy for preoperative evaluation of patients presenting with imaging-confirmed hernia diagnoses. For postoperative evaluation, surgeons reported comfort with evaluation of low-complexity hernia repairs via telemedicine encounters. The majority of surgeons anticipate an increase in telemedicine utilization if emergency regulations are maintained in the post-pandemic period. We were encouraged that barriers to implementation were perceived as minor to moderate inconveniences for most respondents.

This study is the first to assess telemedicine utilization among subspecialty surgeons. Prior studies have evaluated patient reported experiences [11], clinical outcomes [12], and the financial implications [13] of telemedicine, but lacked the granularity necessary to understand how telemedicine approaches can be utilized in various clinical scenarios and phases of care. We were encouraged to identify trends in specific case types that appear to be more conducive to a virtual visit format. In particular, surgeons appeared to have greater degrees of comfort associated with evaluating patients with image-confirmed diagnoses. It appears that surgeons were universally more comfortable with postoperative evaluation of patients, irrespective of the type of hernia or operation performed. Surgeons may have favored postoperative visits for a variety of reasons, including having an established relationship with patients, low complication rates among the case types evaluated, and a greater degree of evidence regarding the safety of postoperative telemedicine evaluations [14, 15]. The description of surgeon perspective of which patients are appropriate for telemedicine evaluation is critical. This allows development of triage criteria for administrative staff to place patients into the appropriate evaluation modality. Future studies need to assess the accuracy of preoperative evaluations performed in the digital setting through prospective studies that evaluate the feasibility, efficacy, and safety of telemedicine strategies for different patient populations.

We also assessed the financial advantages and disadvantages of delivering care via telemedicine. From a surgeon perspective, we reviewed reimbursement strategies to determine the impact of the recent emergency interventions by CMS to establish reimbursement parity. Prior to the COVID-19 pandemic, reimbursement was available for a small proportion of preoperative services rendered in designated clinic locations or rural patient populations [16, 17]. As a result, most surgeons only implemented telemedicine in postoperative care, where reimbursement was based on bundled payments. Our respondents reaffirmed that maintenance of emergency measures taken by CMS to establish payment parity in the post-pandemic period would increase telemedicine utilization. Though we did not evaluate patient experiences in this study, others have evaluated cost related to travel and missed work, demonstrating that virtual visits can be cost-effective means for patients to be evaluated [18, 19]. Further studies should examine financial implications for other stakeholders, including institutions who would have less facility costs associated with virtual care.

Respondents cited concerns related to patient engagement and connectivity. Surgeons participating in our survey used a variety of platforms to connect with patients. Currently, HIPAA regulations have been paused to facilitate telemedicine assessments, but these temporary regulatory changes stand to convert back to pre-pandemic approaches. Recent work by Kemp et al. [14] demonstrated that no-show rates in telemedicine clinics are higher in African-American and single parent households. Studies evaluating patient engagement with electronic medical record-based applications and smart phones will need to be

Table 4 Respondent Perceptions of Viability of Video-based evaluations by Diagnosis, Procedure, and Phase of Care

	Practice duration, years			Practice setting			Fellowship training		
	< 15 (*n* = 19) *n* (%)	> 15 (*n* = 17); *n* (%)	*P Value*	Academic (*n* = 16) *n* (%)	Private (*n* = 20) *n* (%)	*P Value*	MIS (*n* = 16) *n* (%)	None/ Other (*n* = 20) *n* (%)	*P Value*
Perceived viability for new patient evaluations	15 (78.9)	5 (29.4)	*0.003*	12 (75)	8 (40)	*0.036*	13 (81.3)	7 (35)	*0.006*
Imaging-confirmed inguinal hernia	18 (94.7)	8 (47.1)	*0.001*	15 (93.8)	11 (55)	*0.010*	16 (100)	10 (50)	*< 0.001*
Clinically diagnosed inguinal hernia	8 (42.1)	4 (23.5)	*0.238*	8 (50)	4 (20)	*0.058*	6 (37.5)	6 (30)	*0.635*
Groin pain*	1 (5.3)	1 (6.3)	*0.935*	1 (6.3)	1 (5.2)	*0.871*	1 (6.3)	1 (5.2)	*0.871*
Clinically diagnosed epigastric/umbilical hernia	10 (52.6)	4 (23.5)	*0.074*	8 (50)	6 (30)	*0.221*	8 (50)	6 (30)	*0.221*
Imaging-confirmed epigastric/umbilical/ flank hernia	18 (94.7)	11 (64.7)	*0.023*	15 (93.8)	14 (70)	*0.074*	16 (100)	13 (65)	*0.008*
Clinically diagnosed incisional/recurrent hernias*	6 (31.6)	3 (18.6)	*0.335*	6 (37.5)	3 (15.8)	*0.121*	6 (37.5)	3 (15.8)	*0.121*
Imaging diagnosed incisional/recurrent hernia	14 (73.7)	9 (52.9)	*0.196*	12 (75)	11 (55)	*0.214*	13 (81.3)	10 (50)	*0.052*
Enterocutaneous Fistula*	5 (26.3)	3 (18.8)	*0.532*	5 (31.3)	3 (15.8)	*0.244*	5 (31.3)	3 (15.8)	*0.244*
Perceived viability for postoperative evaluations	19 (100)	14 (82.4)	*0.056*	16 (100)	17 (85)	*0.106*	16 (100)	17 (85)	*0.106*
Open repair of inguinal/femoral hernia	19 (100)	13 (76.5)	*0.025*	15 (93.8)	17 (85)	*0.406*	16 (100)	16 (80)	*0.058*
MIS repair of inguinal/femoral hernia	19 (100)	14 (82.4)	*0.056*	15 (93.8)	18 (90)	*0.686*	16 (100)	17 (85)	*0.106*
Surgery for groin pain	13 (68.4)	9 (52.9)	*0.342*	11 (68.8)	11 (55)	*0.400*	13 (81.3)	9 (45)	*0.027*
Open Repair of Ventral/Incisional Hernia without myofascial release	18 (94.7)	10 (58.8)	*0.010*	15 (93.8)	13 (65)	*0.039*	15 (93.8)	13 (65)_	*0.039*
MIS Repair of ventral/incisional hernias without myofascial release	18 (94.7)	11 (64.7)	*0.023*	15 (93.8)	14 (70)	*0.074*	15 (93.8)	14 (70)	*0.074*
Open/MIS repair of ventral/incisional hernia with myofascial release	12 (63.2)	7 (41.2)	*0.187*	12 (75)	7 (35)	*0.017*	11 (68.8)	8 (40)	*0.086*
Planned post-pandemic telehealth utilization relative to pre-pandemic			*0.448*			*0.115*			*0.394*
Decreased	0 (0)	1 (5.9)		0 (0)	1 (5)		0 (0)	1 (5)	
Increased	16 (84.2)	12 (70.6)		15 (93.8)	13 (65)		14 (87.5)	14 (70)	
No Change	3 (15.8)	4 (23.5)		1 (6.3)	6 (30)		2 (12.5)	5 (25)	

*Out of 35 respondents. Abbreviations: MIS = minimally invasive surgery

conducted to determine disparities in access to digital health [20].

While our research was able to glean granular data about the usage and perception of telemedicine among hernia surgeons, it has certain limitations. The targeted demographic was hernia and abdominal core health surgeons with results specific to hernia care. Our responding cohort and response rate was small; however, we were able to reach a highly experienced and specialized group of surgeons lending credibility to our findings. Further, the results lack generalizability to other specialties, and telemedicine may have a different dynamic as it relates to the workflow of other specialties (i.e., vascular/wound care clinics where in-person exam may be indispensable to decision making). Finally, the study population was limited to surgeons; further studies will be needed to assess patient and nursing staff perceptions and comfort with the use of telemedicine experiences before permanent changes are implemented.

Table 5 Perceived barriers to utilization of telehealth

Responses (total 36)	*n* (%)		
Perceived barriers to telehealth utilization	Minor	Moderate	Significant
Patient engagement	15 (42%)	10 (28%)	11 (31%)
Connectivity	15 (42%)	11 (31%)	10 (28%)
Cost/reimbursement	18 (50%)	10 (28%)	8 (22%)
Security	23 (64%)	9 (25%)	4 (11%)
Scalability	22 (61%)	11 (31%)	3 (8%)
Staffing	23 (64%)	11 (31%)	2 (6%)
Provider/institutional resistance	27 (75%)	8 (22%)	1 (3%)
Lack of medical records	27 (75%)	9 (25%)	0 (0%)

Our study demonstrates that hernia surgeons utilized telemedicine approaches to ensure patients maintain access to perioperative care for elective hernia and abdominal core health concerns. Surgeons appear interested in implementing telemedicine strategies to provide care beyond the COVID-19 pandemic. We identify patient populations which may benefit from expansion of current regulations. Further, we identify barriers to telemedicine expansion that need to be addressed to optimize the experience for all stakeholders.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00268-021-06332-9.

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Declarations

Conflict of interest Authors of this manuscript have each reviewed their conflict of interest/disclosure and funding/support relationships and deny any competing interests that potentially or inappropriately influence their work or conclusions in this manuscript.

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