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Telemedicine (virtual clinic) effectively delivers the required healthcare service for pediatric ambulatory surgical patients during the current era of COVID-19 pandemic: A mixed descriptive study

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ABSTRACT

Background: Children often suffer from congenital or acquired diseases. Ambulatory cases represent the vast majority of pediatric surgical cases. COVID-19 pandemic-associated regulatory precautions had made the process of seeking medical advice at a suitable appointment such a big problem. We utilized telemedicine (online encounter) to deliver the required healthcare service for sorting and guiding pediatric ambulatory surgical patients. In this article, we aimed to: (1) present our experience, (2) evaluate the effectiveness, and (3) document the results of this technology to solve the problem of difficult healthcare accessibility.

Materials and methods: In this study, we compared the utilization of telemedicine (virtual clinic via video consultation) prospectively in the current era of the COVID-19 pandemic in the period from June 2020 to July 2021 to the in-person clinic encounter at the outpatient department (OPD) retrospectively in the previous year (from June 2019 until the end of May 2020) for perioperative management of pediatric ambulatory surgical patients. The study was conducted at 3 tertiary care pediatric surgery centers. The information recorded for analysis included: demographic data, surgical condition distribution, time interval from the appointment request till the actual encounter with the surgeon, conversation duration, distance traveled, and ultimate fate of the consultations. For both groups, service was evaluated after the first follow-up visit by a patient survey questionnaire (Patient Experience Assessment form) including questions relevant to each encounter.

Results: A total of 1124 pediatric patients with various ambulatory surgical conditions had been scheduled for virtual clinic video encounters. Of them, 1056 cases were evaluated by video consultation, supervised by their parents or caregivers, thus, achieving an attendance rate of 94%. Of the remaining cases, 2% ($n = 23$) were canceled and 4% ($n = 45$) did not attend the virtual clinic. Two-thirds of the cases live in rural /remote areas. Patients' overall satisfaction was 92%. This was in comparison to 872 pediatric ambulatory surgical patients scheduled for in-person clinic visits before the implementation of the virtual clinic. Of them, only 340 cases had attended the clinic, thus, achieving an attendance rate of 39%. Of the remaining cases, 450 cases (51.6%) were canceled and 82 cases (9.4%) did not attend the clinic (no show). About 48% of the cases live in rural areas. For this group, patients' overall satisfaction was 63%.

The mean encounter duration was similar for both groups (~ 5 min). Surgical condition distribution was also similar (p -value: 0.694). For new cases, the time interval from appointment request till the actual encounter was very short for the virtual clinic group (range: 6–15 days) as compared to the in-person clinic group (range: 30–180 days). Patients were followed up for a median period of 14 ± 3.25 months (range: 6–22 months) with no patient loss to follow-up.

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Conclusion: Telemedicine can effectively bridge the patient-physician communication gap caused by the regulatory precautions mandated by the current COVID-19 pandemic. It achieved an attendance rate of 94% and parents' / patients' overall satisfaction of 92%.

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1. Introduction

Since WHO declared COVID-19 as a pandemic disease, the whole healthcare sector had become enormously affected, including the field of pediatric surgery. Parents usually seek clinic appointments for medical advice. Obtaining an OPD appointment for pediatric ambulatory surgical problem at a suitable date is a challenging issue. The first appointment could often be available after 3–6 months and even may exceed. The COVID-19 pandemic-associated restrictions and regulatory precautions had complicated the accessibility and physical attendance of outpatient clinics. Moreover, early during the crisis, OPD appointment employees were instructed to cancel many cases to avoid patient overcrowding and achieve social distancing in an attempt to limit the disease spread. Approximately, only the emergency cases were allowed to receive medical care [1,2].

Telemedicine enables remote access to healthcare services and mutual interaction between the physician and patient /parent. It avoids transportation, parking, and school and work missed days; therefore, it saves both money and time. By its implementation in the field of pediatric ambulatory surgery, the chain of care will be preserved and the waiting list will be reduced. Thanks to its simplicity, attendance rate can be maximized while no show and cancellation rates can be minimized [1,3,4].

Video consultation, being superior to text messaging and voice conversation, is and will remain the proper alternative for the gold standard face-to-face clinic visit. It maintains the required relationship between the physician and the patients /parents including audio-visual communication, enables revision of the medical file data, and yields a constructive conversation. Finally, it ensures that the patients /parents have understood the instructions and agreed to the management plan [4].

To the best of our knowledge, no previous study in our region had searched the role of telemedicine with its multipurpose potentials (preoperative assessment, sorting, possible referral of irrelevant cases, and postoperative follow-up) for the management of pediatric ambulatory surgical cases. So, we performed this study to check the feasibility and acceptability of adopting telemedicine to deliver the required healthcare service for these patients. In this article, we aimed to present our experience, evaluate the effectiveness, report the outcomes of the application of telemedicine (virtual clinic), and to answer the question: Is telemedicine a suitable alternative that can overcome the social barriers imposed by the COVID-19 pandemic?

2. Patients and methods

This mixed descriptive study was conducted at 3 tertiary care pediatric surgery centers (Prince Mohammed bin Abdulaziz hospital in Riyadh, Alyamamah Maternity & Children's hospital in Riyadh, and Al-Azhar University hospitals in Cairo). It compared the utilization of telemedicine (virtual clinic via video consultation) prospectively in the current era of COVID-19 pandemic in the period from June 2020 to July 2021 to the in-person encounter at the outpatient department (OPD) retrospectively in the previous year (from June 2019 until the end of May 2020) for perioperative management of pediatric ambulatory surgical patients. The information recorded for analysis included: demographic data, surgical condition distribution, time interval from the appointment re-

quest (for new cases and follow-up cases) till the actual encounter with the surgeon, encounter duration, distance traveled, and ultimate fate of the consultations. After the first follow-up visit, the service was evaluated by a survey questionnaire (Table 1) (Patient's Experience Assessment form) that was also used for the in-person clinic group. It included questions relevant to each encounter. This questionnaire is one of the fundamental standards of our hospitals' policy to improve the service quality. The survey was made anonymous, i.e., there was no need to mention or sign the patient's name. It was delivered in paper form before the COVID-19 crisis, then, it became an electronic form (Google form), concomitant with the regulatory precautions. Its link was sent to the parents via a short message service (SMS) or an e-mail from the official account of *Press Ganey* international company or *Health Links* local company. These companies act as official third-party agencies, dedicated to assessing the patients' experience and satisfaction rate independently to avoid any selection bias. Survey request was preceded by the preface Dear customer: kindly fill the following survey questionnaire honestly and comfortably. We emphasize that the collected data will be handled with extreme confidentiality, security, and respected privacy. It will be used only for scientific research purposes to improve the healthcare and medical service quality.

All guardians of patients enrolled in the study had electronically signed informed consent before the start of the video consultation. The study was approved by the Institutional Review Board and ethics committee (IRB00012367–20–05–016) and also registered at ClinicalTrials.gov (ID: NCT04990570). The main objective was to assess the efficacy of telemedicine in sorting and guiding pediatric ambulatory surgical patients correctly. Primary outcome measurements included: attendance, no show, cancellation, complications and re-admission rates, and parents' /patients' experience evaluation. Secondary outcome measurements included: time interval from the appointment request till the actual encounter, encounter duration, and fate of the consultations.

In the current study, the mainly used application for video consultation was *Sehhaty*®, developed by *Lean Business Services* company in Saudi Arabia. It is a charge-free telemedicine application, launched in the 2nd quarter of 2020. It had been approved by the governmental committee of ministries and authorities of Health, Health Information, Health Council, Quality & Accreditation, Data and Artificial Intelligence, and Communications and Information Technology. This was to fulfill the required constitutional legislative licensure for encryption, storing, sharing, and transmission of data to guarantee the patient's privacy and to protect the data security. In Egypt, *Se7etak*® application was used. It was developed by *Se7at Masr Health Services* company. It was exceptionally licensed by the Ministry of Health since May 2020. It had not yet been fully approved by other governmental agencies, so, it had limited facilities (online clinic appointment booking and time-limited video consultation for a price). Internet-based communication applications such as *Messenger*®, *Telegram*®, and *WhatsApp*® were utilized as charge-free adjuvant tools to permit unlimited audio-video conversation and data sharing.

Surgeons, parents, and older patients were trained and instructed on how to use the applications. Surgeons were trained in their respective institutions to be professional, strict, and committed to the policy and ethics of the video encounter. In addition, they were trained to respect patients' data privacy and security,

Table 1
Patient's Experience Assessment form survey.

Item	Rank
The processes of registration and further activation of the medical file were easy.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
I did not face any problems with the registration or login step.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
The video-call streaming was smooth and I did not face any interruptions.	
The time interval from the appointment request till the actual encounter.	1 <input type="checkbox"/> > 6 months, 2 <input type="checkbox"/> ≤ 6 months, 3 <input type="checkbox"/> ≤ 3 month, 4 <input type="checkbox"/> ≤ 1 month, 5 <input type="checkbox"/> ≤ 1 week
I received a reminder message the day before the encounter.	<input type="checkbox"/> No (= 1) <input type="checkbox"/> Yes (= 5)
For me, the appointment was convenient and did not interfere with any of my daily scheduled duties.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
I was asked to sign the consent before the video consultation.	<input type="checkbox"/> No (= 1) <input type="checkbox"/> Yes (= 5)
The physician adequately introduced himself to me.	<input type="checkbox"/> No (= 1) <input type="checkbox"/> Yes (= 5)
The physician then verified my identity.	<input type="checkbox"/> No (= 1) <input type="checkbox"/> Yes (= 5)
The physician gave me enough time to describe the case and express my fears and inquiries.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
The physician was calm and used clear easily understandable terms during his discussion.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
The physician was kind and empathic with me as he listened carefully and paid adequate attention to my concerns.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
The physician respected my privacy.	<input type="checkbox"/> No (= 1) <input type="checkbox"/> Yes (= 5)
I have understood and agreed to the management plan.	<input type="checkbox"/> No (= 1) <input type="checkbox"/> Yes (= 5)
I received clear patient education about home medications, wound care, follow-up instructions, and any probable complications.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
It was easy to reach the physician to get medical care if postoperative unpleasant events occurred.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
The physician was competent, well-trained, and trustworthy. He treated me in a very friendly courteous manner.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
Any other concerns such as parking, cleanliness, time in the waiting area, physician or nurse attitude in the clinic, OPD reception office or admission office employees' care and attention.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
There was no significant difference between in-person clinic visits and video consultation encounters.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
Overall, the service was excellent and it met my expectations.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
Do you have any suggestions or comments to improve the service?	Free text.....
I recommend this service to the others (as my relative's or friend's kids).	<input type="checkbox"/> 1 = Very unlikely, <input type="checkbox"/> 2 = Unlikely, <input type="checkbox"/> 3 = Uncertain, <input type="checkbox"/> 4 = Likely, <input type="checkbox"/> 5 =, Strongly (very likely)

1 = extremely dissatisfied, 2 = dissatisfied, 3 = uncertain, 4 = satisfied, 5 =, extremely satisfied

how to start and how to finish the encounter politely, and how to adequately answer the patients' questions and discuss with them the management plan including post-operative follow-up instructions. Patients were instructed via the application's notifications or SMS explaining their rights and responsibilities, how to electronically sign the informed consent, how to manage the conversation, and how to evaluate the service. They can use either a smartphone, tablet, or laptop with a stable internet connection. Parents /older patients were sent a reminder message via SMS, e-mail, or the application notifications the day before the encounter to save date and time and prepare themselves.

As a general governmental policy, all patients were requested to register on the MOH eligibility and registration online site (including ID, phone number, address, and e-mail). Notably important is the location on the GPS that should be activated during the initial registration to help determine the nearest pediatric surgical center for possible online referral or ambulance transportation. Also, pediatric surgery specialists were continuously allocated on duty (on a 24/7-time basis).

2.1. Inclusion criteria

All children from 1 month to 14 years of age with ambulatory surgical issues and motivated parents were included.

2.2. Exclusion criteria

Parent's refusal of the service, uncooperative parents or patients, patients older than 14 years, and cases with proximal hypospadias with chordee were excluded from the study.

2.3. Protocol and ethics of the virtual clinic encounter

These ethics should be followed by the physician during the video consultation and are summarized in Table 2.

2.4. Statistical analysis

Data were analyzed using the statistical package for social sciences (SPSS) version 24.0 (IBM Corp, IBM SPSS Statistics for Windows, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), range, and average while categorical variables were expressed as frequency count and percent. Fisher's exact test was used to compare frequency count and percent. The *t*-test was used to compare the mean values as appropriate. A two-sided *p*-value less than 0.05 was considered statistically significant.

3. Results

A total of 1124 pediatric patients with various ambulatory surgical conditions had been scheduled for virtual clinic encounters via video consultation. Of them, 1056 cases were evaluated by video consultations, supervised by their parents /caregivers, thus, achieving an attendance rate of 94%. They were 570 males and 486 females. About two-thirds of them live in rural or remote areas (Table 3). Among them, 686 cases (65%) had been scheduled for the nearest operative room (OR) list, 106 cases (10%) (with constipation, vaginal or encysted hydrocele versus inguinal hernia, retractile testis, curved penis) were given an in-person clinic appointment for a more accurate examination, 74 cases (7%) with midline facial dermoid cysts, thyroglossal and branchial arch anomalies, cutaneous hemangioma, and syndactyly, were sent a request for further radiologic investigations (U/S, CT, MRI, according to the case, to rule out intracranial connection, to delineate the neck anomaly track and anatomical relations, to rule out associated visceral hemangioma, and to detect bony /joint connection, respectively), and 63 cases (6%) with scoliosis, occipital encephalocele /spina bifida occulta, ptosis /squint were referred to other surgical specialties (orthopedics, neurosurgery, and ophthalmology, re-

Table 2

Protocol and ethics of the virtual clinic encounter.

- a- The physician should sit in a quiet room, with adequate light, wear a headset, and use a laptop or desktop computer with a stable internet connection.
- b- He should confirm that the parent /older patient had electronically signed the informed consent before starting the video consultation.
- c- He should be professional and self-confident.
- d- Firstly, he should identify himself (state his name, title, and position) and then verify the patient's identity.
- e- He should reassure the patient that his/her data will remain private, respected, and protected.
- f- He should keep eye contact with the patient /parent on the screen, and simultaneously revise the patient's medical file.
- g- He should ensure that the management plan has been understood and agreed upon by the parent or older patient.

Table 3

Demographic data and encounter circumstances.

Item	Virtual clinic group	In-person clinic group	P-value
Age (mean± SD, range)	1.2 ± 3.6 (0.1–14)	1.6 ± 2.7 (0.1–14)	0.649
Gender (n,%)			0.869
Male	570 (54%)	453 (52%)	
Female	486 (46%)	419 (48%)	
Residence area (n,%)			0.05
Urban	355 (33.6%)	456 (52.3%)	
Rural	701 (66.4%)	416 (47.7%)	
Total number of scheduled cases	1124	872	0.687
Time interval from appointment request till the actual encounter (in days):			
New cases (mean± SD, range)	9 ± 0.6 (6–15)	50±19 (30–180)	0.032
Follow-up cases	On-time	On-time	1.00
Encounter duration (in minutes) mean± SD, range	5 ± 3.5 (8–15)	5.5 ± 2.9 (7–16)	0.836
Distance traveled (in kilometer) mean± SD, range	0	85±39.75 (18–312)	<0.001
Ultimate fate of consultations (n,%)			0.692
Reassurance and follow-up	127 case (12%)	51 case (15%)	
Schedule for the nearest OR list	686 case (65%)	228 case (67%)	
Reschedule for the in-person clinic visit	106 case (10%)	—	
Request further investigations	74 case (7%)	37 case (11%)	
Referral to other surgical specialties	63 case (6%)	24 case (7%)	

Table 4

Study measurement items.

Item	Virtual clinic group	In-person clinic group	P-value
Attendance rate (%)	94%	39%	0.03
No show rate (%)	3%	9.4%	0.04
Cancellation rate (%)	3%	51.6%	0.01
Overall Complication rate (%)	20/840 (2.4%)	7/265 (2.6%)	0.538
Re-admission rate (%)	7/840 (0.8%)	3/265 (1.1%)	
Patients /parents' overall satisfaction (%)	92%	63%	0.04

spectively). Parents' overall satisfaction was 92%. Among them, satisfaction was extreme in 86%, very good in 75%, good in 52%, and fair (uncertain) in 35% of cases. Only 8% of cases were dissatisfied with the service (due to non-physician-related reasons such as being not convinced by the online encounter, internet problems with repeated connection interruptions, or that the determined appointment had interfered with their duties). This was in comparison to 872 pediatric ambulatory surgical patients scheduled for in-person clinic visits during the period from June 2019 to the end of May 2020, of whom, only 340 cases (39%) attended the clinic. Of the remaining cases, 450 cases (51.6%) were canceled and 82 cases (9.4%) did not attend the clinic (no show) (Table 4). For the in-person clinic group, patients' overall satisfaction was 63%, while the remaining 37% of cases were dissatisfied because of several issues such as parking, cleanliness, time spent in the waiting area, physician or nurse attitude in the clinic, OPD reception office or admission office employees' care and attention. As regards the response to the experience survey questionnaire, it was 92.8% (980 of 1056 cases) for the videoconferencing group and 93.5% (318 of 340 cases) for the in-person clinic group.

Surgical conditions' distribution was similar between both groups (*p*-value 0.694), where uncircumcision was the most common diagnosis, followed by inguinal hernia or hydrocele, undescended testis, distal hypospadias, meatal stenosis, umbilical her-

nia, tongue tie, external angular dermoid, lipoma, sebaceous cyst. However, the virtual clinic group exceeded the in-person group by the following diagnoses: lymph node biopsy, thyroglossal cyst /fistula, branchial cyst /sinus or cartilage remnant, localized cutaneous hemangioma, simple ganglion, pilonidal sinus, and polydactyly /syndactyly (Table 5).

Reassurance and follow-up were decided for 127 cases (12%); including 36 cases with hydrocele younger than 1 year, 27 cases with retractile testes, 25 cases with umbilical hernia younger than 3 years, 18 cases with localized cutaneous hemangioma, and 21 cases with tongue tie younger than 1 year.

3.1. Follow up

Patients were followed up for a median period of 14±3.25 months (range, 6–22 months) with no patient loss to follow-up. Follow-up was scheduled weekly for the 1st month, then monthly as indicated. Post-operative follow-up items included: general condition, appetite, bowel habit, compliance to prescribed medications, temperature, wound integrity, hemostasis, incision site swelling, redness, tenderness, discharge, recurrence, or any other related concerns.

Table 5
Virtual clinic and In-person OPD clinic cases distribution and ratio (%).

Virtual clinic	In-person OPD clinic
Uncircumcision (42%)	Uncircumcision (45%)
Inguinoscrotal conditions as hernia, hydrocele, & undescended testis (23%)	Inguinoscrotal conditions as hernia, hydrocele, & undescended testis (23%)
Distal hypospadias /congenital meatal stenosis (10%)	Distal hypospadias /congenital meatal stenosis (11%)
Umbilical hernia (7%)	Umbilical hernia (9%)
Tongue tie (6%)	Tongue tie (7%)
Superficial swelling as lipoma, dermoid cyst (3%)	Superficial swelling as lipoma, dermoid cyst (5%)
Lymph node biopsy (2.7%)	
Thyroglossal duct /Branchial apparatus anomaly (2.1%)	
Simple ganglion (1.5%)	
Pilonidal sinus (0.9%)	
Polydactyly /syndactyly (0.6%)	

3.2. Complications and re-admission

Of the virtual clinic group, 20 of 840 operated cases (~2.4%) developed complications. They were 5 cases with post-circumcision significant bleeding, 4 cases with post herniotomy severe wound infection, 6 cases with hernia recurrence, and 5 cases with urine retention after repair of distal hypospadias after catheter removal. Among them, only 7 cases (0.83%) required re-admission; including 3 cases with post circumcission significant bleeding (for hemostasis and possible blood transfusion), 2 cases with post herniotomy purulent wound discharge (for parenteral antibiotics administration and local wound care), and 2 cases with urine retention after distal hypospadias repair (for conservative management and possible catheter placement). Of the in-person group, 7 cases of 265 operated cases (~2.6%) developed complications; including 2 cases with post-circumcision significant bleeding, 2 cases with post herniotomy severe wound infection, and 3 cases with urine retention after repair of distal hypospadias. Among them, only 3 cases (1.13%) had significant complications and required re-admission for proper management.

4. Discussion

This study aimed to present our experience, evaluate the effectiveness, and report the outcomes of the application of telemedicine (virtual clinic) to provide the required healthcare services for pediatric ambulatory surgical patients during the current era of the COVID-19 pandemic, in comparison to the in-person clinic encounter.

COVID-19 pandemic has greatly augmented the implementation of telemedicine for providing healthcare service, especially in the outpatient settings, to protect the patients and their caregivers from exposure to SARS-CoV-2 infection [5].

Among the known various forms of telemedicine, we have chosen the video consultation modality to manage the virtual clinic and approach our patients in all phases of ambulatory surgical care.

In the current study, we found that telemedicine can effectively be used in preoperative diagnosis and sorting of patients. Most cases were easily diagnosed by *spot diagnosis*, except cases with unclear diagnoses such as constipation (to do digital rectal examination), vaginal or encysted hydrocele (to differentiate it from inguinal hernia or undescended testis), retractile testis (to verify the diagnosis), and curved penis (to assess the type and degree of curvature and determine the location of external urethral meatus). These cases were referred to the OPD clinic for physical examination. Also, Lee et al. used low-bandwidth telemedicine for evaluation and screening of patients, where the relevant physical examination and radiographic studies were image-captured and sent for consultation. They concluded that internet-based surgical remote

sorting is cheap and effective and exactly consistent with the on-site preoperative diagnosis [6].

Regarding the time interval from the appointment request till the actual encounter with the surgeon, this is an important point. It demonstrates the rapid response, extreme ease, and flexibility to find the first available nearest appointment to provide services via the virtual clinic in comparison to the in-person clinic, especially for cases from rural or peripheral areas. With telemedicine, distance no longer became a hindering issue. In a similar article, Chen et al. used an electronic referral hospital system and found the average waiting time for the patient to be seen by a specialist had decreased from 112 to 49 days, and the number of unclear surgical patients' referrals decreased by 75% after using a telemedicine consult service [7].

In the current study, the encounter duration was similar between virtual consultations and in-person clinic visits. This was contrary to Postuma and Loewen who utilized telephone-based videoconferencing for plastic surgery consultations and found that telehealth assessments consumed longer time than the in-person visits, but with time and increased experience, the duration of both became similar [8].

In the current study, we found that telemedicine effectively offers an adequate post-operative follow-up service, without jeopardizing the optimum patient's care. If the video consultation revealed significant bleeding, severe infection, purulent discharge, recurrence, or post-operative urine retention associated with agonizing pain, the parent /patient was advised to go urgently to the emergency room (ER) department for management of complications and possible re-admission. Similarly, Canon et al. used online clinic video-conferencing (through a general commercial model) for postoperative follow-up after hypospadias /epispadias repair, circumcision, correction of buried penis, orchidopexy, orchidectomy, hernia repair, and hydrocelectomy. They compared them to the in-person clinic visits and concluded that postoperative evaluation as well as the number of visits were nearly equal for both groups. No extra visits were further required [9].

Also, Goedeke et al. performed a prospective randomized controlled trial to evaluate the quality and perception of telemedicine video consultation for follow-up of pediatric surgical patients after home discharge. They concluded that telemedicine follow-up is cost-effective, well-received, and accepted because it gives sufficient data about the wound, therefore, it avoids unnecessary visits to the ER department. Also, clinical information sharing was good enough to deliver safe healthcare without compromising the clinical decision. The presence of available appointments at the in-person clinic is important when there was uncertainty at the telemedicine encounter [10].

In their article about the application of telehealth phone calls for post-operative follow-up after open herniorrhaphy and laparoscopic cholecystectomy to assess patients' satisfaction and report the postoperative complications, Hwa and Wren found 110 of to-

tal 141 cases (78%) were successfully phone contacted. Of them, 63 hernia repair cases (70.8%) and 19 laparoscopic cholecystectomy cases (90.5%) accepted telehealth phone calls as the main follow-up tool. Also, they reported no complications after laparoscopic cholecystectomy and 3 complications after hernia repair. They concluded that telehealth can be safely used as an alternative to the in-person clinic visits for follow-up of selected ambulatory surgical procedures with a high degree of patient satisfaction [4]. In our study, we also used videoconferencing for follow-up purposes.

In the current study, surgical outcomes (complication and re-admission rates) were found to be similar in both groups. Presumably, this may be due to similarity in perioperative circumstances including preoperative diagnoses either via telemedicine or in-person visit, same surgeons and allied surgical teams, operations, hospital facilities, and follow-up. Preoperative visits did not detect any risk factors or missed diagnoses. Only, 13 cases with a provisional diagnosis of inguinal hernia on video consultation were found to have their diagnosis changed to hydrocele ($n = 7$), palpable undescended testis ($n = 4$), and inguinal lipoma ($n = 2$) when examined on the operative day morning. However, no surgery was canceled or required any adjustment.

In agreement with the high parents /patients' attendance rate of the telemedicine encounter found in the current study, Chang et al. conducted a prospective study to evaluate the efficacy of a Chinese smartphone app (*WeChat*)-assisted medical care for post-operative compliance to follow-up after pediatric cataract surgery. They found significantly higher compliance (93.6%) in the subsequent appointments in the *WeChat* group, as compared to 80.5% in the control group [11]. Also, Liu et al. conducted a randomized controlled trial to investigate the influences of *WeChat*-assisted perioperative instructions for pediatric ambulatory hernia repair regarding parents' knowledge, cancellation rate, lost-to-follow-up rate, and complication rate by the end of the first postoperative week. They found a significant difference in the mean knowledge score and cancellation rate between the *WeChat* group and the control group, a significantly lower lost-to-follow-up rate in the *WeChat* group (0.54%) than the control group (3.66%), and a higher complication rate in the control group [12]. Both previous studies confirmed that telemedicine offered an easily suitable encounter and achieved a higher attendance rate.

As noted in the current study, the rates of cancellation and no-show were higher in the in-person clinic group than the virtual clinic group, presumably due to the regulatory precautions mandated by the COVID-19 pandemic. These regulatory precautions had been started in Saudi Arabia on 2nd March 2020 and included: social distancing, the curfew (movement restriction), and later on, the vaccination campaign. However, initially, the vaccination campaign was met by reluctance, so, people were ineligible to enter the healthcare institutions unless being vaccinated by at least one dose. In Egypt, the regulatory precautions had been started in mid-March 2020.

In the current study, assessment survey questions for both groups (virtual and in-person) were made nearly similar to unify the points of interest. Also, they were formulated in a clear, understandable manner to be easily answered by the audience, regardless of their financial income or educational level.

Canon et al. found that telemedicine facilitates and maintains the strong link between patients /parents and the healthcare provider (HCP) [9]. This is consistent with the aim and results of the current study.

In the present study, we found telemedicine effectively facilitated easy access to healthcare services for a wide range of patient populations even from remote or peripheral areas, and minimized the cost of traveling long distances. Also, it avoided work or school missed days and reduced the rate of unexpected hospital re-admission, as supported by other studies [3,8,9,11].

From the authors' point of view, telemedicine (specifically the virtual clinic) can bridge the communication gap resulted from COVID-19 pandemic regulatory precautions and approximates the distances between patients and physicians. It mimics the in-person OPD encounter, provided that the rules and ethics are similarly considered.

4.1. Drawbacks of the study and future recommendations

The relatively short duration of the study may be a drawback. Like any new technology, telemedicine has some limitations, including that (1) it is relatively not widespread, (2) it is not uniformly accepted, (3) it necessitates the presence of communication equipment with a stable internet connection, and (4) it requires training of the physicians and parents or caregivers, assuming that they have an adequate cultural background, which is not always the case. Also, regarding the results of the Patient Experience Assessment form obtained retrospectively from the in-person clinic group, they may be liable to recall bias. As this study was conducted in 2 Middle East countries, patient perceptions of telehealth as well as its potential benefits were influenced by the cultural and regulatory characteristics that may be specific to this region and population. Therefore, some findings of this study may not be generalizable. We recommend further long-term randomized controlled trials to be conducted on more specific points of research; such as a certain disease or condition, postoperative follow-up, or the feasibility of application of telemedicine in trauma settings, to widen the scope of thinking and expand the field of research about this valuable technology.

5. Conclusion

Tailoring the application of telemedicine via virtual clinic for the field of pediatric ambulatory surgery effectively maintains the patient-physician relationship, saves time, increases parents' /patients' satisfaction, and helps record better experiences as compared to the in-person clinic visit. Video consultation is a reliable surrogate encounter, especially during global health and social crises.

Ethical consideration

The study design was approved by the Institutional Review Board and ethics committee of the hospitals and met all the guidelines of their responsible governmental agency. It was performed according to the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Authorship

The authors attest that they meet the current ICMJE criteria for authorship.

Type of study

Mixed prospective /retrospective descriptive study including 2 sequential groups.

Level of evidence

Level VI.

Declaration of Competing Interest

All authors state that they have no conflicts of interest or competing interests.

CRediT authorship contribution statement

Muhammad Abdelhafez Mahmoud: Conceptualization, Visualization, Data curation, Formal analysis, Writing – review & editing, Writing – original draft. **Mohammad Daboos:** Conceptualization, Visualization, Data curation, Formal analysis, Writing – review & editing, Writing – original draft, Supervision. **Samir Gouda:** Writing – review & editing, Supervision. **Alsayed Othman:** Formal analysis, Writing – review & editing. **Mohamed Abdelmaboud:** Data curation, Formal analysis, Writing – review & editing, Supervision. **Mohamed Elsayed Hussein:** Data curation, Formal analysis, Writing – review & editing, Supervision. **Mabrouk Akl:** Data curation, Writing – review & editing, Supervision.

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Supplementary materials

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