

Resumption of Short-term Burn Reconstruction Missions to Ukraine in Light of COVID-19: A Paradigm Shift

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The COVID-19 pandemic has disrupted the lives of billions of people globally. Some medical systems continue to be overburdened due to the viral illness leading to incredible public health challenges domestically as well as abroad. However, with vaccination distribution increasing globally, many are pushing for a return to some form of normalcy. In the medical community, some are weighing the risks of returning to global health missions and considering protective strategies to minimize risk of viral spread. Here, we describe our experience in returning to an annual burn reconstruction mission in a low- and middle-income country. We have successfully carried out a return surgical mission trip. Our team of 10 individuals was able to perform over 75 procedures on 25 pediatric patients in 4 operative days. We applied a variety of protective strategies and altered mission protocol to limit exposure and transmission risk while focusing heavily on education and training. Additionally, we increased the use of telemedicine and eliminated typical in-person clinic visits. We increased operative complexity to increase impact while limiting patient exposure. Rigorous perioperative safety and follow-up protocols were implemented. The increased use of telemedicine, reduction of in-person visits, emphasis on education, and implementation of safety and follow-up protocols have led to an improvement in efficiency, safety, and accountability. Our adaptations have provided guidance on responsibly resuming surgical outreach missions, with changes that are likely to endure beyond the COVID-19 pandemic.

The COVID-19 pandemic has disrupted the lives of billions of people globally, causing casualties on a scale which may soon rival the HIV/AIDS pandemic. As of December 2021, the current global COVID-19 death toll is estimated to range between 11 and 20 million.¹ Health systems continue to be overwhelmed with insufficient resources and personnel to properly care for those suffering from severe COVID-19 infection. Many restrictions aimed to prevent the spread of disease are still in effect on the national and state level. However, with vaccination distribution increasing globally, many are pushing for a return to normalcy with an ease on restrictions. This is seen in the medical community with some individuals weighing the benefits of returning to global health missions with the risk of increasing viral spread both abroad, as well as domestically, and the risk of personal harm.

The full effects of the COVID-19 pandemic on the incidence and severity of disease remain to be seen. Preliminary data show conflicting impact on the incidence of burn injury. Some report a reduction, attributed to mandated stay-home orders, or restrictions on socialization,^{2,3} whereas others show an increase in burn incidence, particularly in the pediatric population.⁴ However, any reduction in incidence may be in part due to a decrease in individuals seeking care over fear of viral exposure. Additionally, the potential reduced incidence of acute burn injury will do little to affect the number of individuals who require reconstructive procedures, which is also negatively affected by the reduction of elective procedures caused by pandemic restrictions. Thus, the need for humanitarian missions focused on burn reconstruction remains high.

Telemedicine has become an increasingly utilized tool in the global health arena. The COVID-19 pandemic has necessitated and accelerated its use in lieu of in-person medical and surgical missions as a means to reduce the burden of global disease. Telemedicine has provided timely international access to expert consultation and triage, multidisciplinary care, and follow-up.^{5,6} However, this technology is limited by the inability to provide direct in-person care, the need for which remains high. Here, we describe our experience in returning to an annual burn reconstruction mission in a low- and middle-income country (LMIC) with the implementation of general preventative measures, as well as alterations in mission protocol to improve efficiency, safety, and accountability.

METHODS

In September of 2021, we proceeded with an annual burn reconstruction mission to a new location in Dnipro, Ukraine.

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The team of 10 practitioners who were fully vaccinated with COVID-19 vaccine traveled from six different states. Patients were preselected for the surgical intervention and interviewed over Zoom (Zoom Video Communications, Inc., San Jose, CA, USA), Skype (Skype Technologies, Microsoft, Redmond, WA, USA), and Viber (Rakuten, Tokyo, Japan). Demographic and clinical data, intraoperative complications, postoperative complications (at 1-week, 1-month, and 2-month follow-up), disposition, and further plans were recorded. Follow-ups took place through telemedicine and photo exchange.

RESULTS

We performed 76 procedures on 25 pediatric patients in 4 operative days (average 3.04 procedures per patient) (Table 1). The patients age ranged from 2 to 22 (10.8), with 18 patients being male (72%) and 6 female (28%). The most commonly performed procedures were: z-plastics ($n = 37$, 49%), full-thickness grafting ($n = 13$, 17%), and split-thickness grafting ($n = 12$, 16%) (Table 1). Most common reconstructive needs included local tissue rearrangement ($n = 23$, 92%), scar release and skin grafting ($n = 18$, 72%), extremity reconstruction ($n = 15$, 60%), facial reconstruction ($n = 7$, 28%), and breast reconstruction ($n = 1$, 4%). A number of patients underwent staged procedures, including ear reconstruction ($n = 2$, 8%), k-wire fixation for extremity reconstruction ($n = 3$, 12%), and placement of a tissue expander ($n = 1$, 4%). We experienced one intraoperative complication (4%). No postoperative complications were reported at 2-month follow-up. There were two cancellations: one person did not need surgical treatment after in-person evaluation and one child had cold-like symptoms on telephone prescreening.

None of our patients reported COVID-19 symptoms during our outreach or within our 1-month follow-up. None of our team experienced COVID-19 symptoms while abroad. One individual developed symptoms upon day 7 of returning, and tested positive the following day. A full recovery was made within 1 week and they were able to return to clinical duties.

DISCUSSION

The COVID-19 pandemic has caused death and morbidity on a global scale, and has affected multiple facets of our lives. The morbidity of other prevalent diseases, including surgically treatable conditions, endures. In the previous year due to the novelty of the COVID-19 virus, travel restrictions, and lack of vaccination, there was a tremendous push for telemedicine in the global surgical arena as a clinical and didactic tool.⁶⁻¹⁰ However, lack of access to appropriate surgical care continues to cause substantial morbidity and mortality globally. For this reason, resuming annual short-term surgical missions is important to providers and their prospective patients. Given the risk of COVID-19 transmission, there is a need to change standard outreach protocols. We established new protocols, ensuring COVID-19 risk minimization, while adhering to four key components: emphasizing education and training, maximizing benefit of direct patient care and telemedicine, preventing perioperative complications, and ensuring accountability with rigorous follow-up. These components,

discussed below, allowed us to successfully execute a sustainable diagonal surgical outreach mission during the COVID-19 pandemic.

Direct Patient Care and Telemedicine

Direct care of patients during outreach missions constitutes the vertical component of a diagonal approach. We sought to strengthen our impact here primarily through preoperative planning through telemedicine. Selecting an appropriate team of skilled surgeons, anesthesiologists, nurses, and residents allowed us to maximize our impact with the available resources. Patients were preselected prior to intervention through telemedicine and photo exchange. Local providers had reached out to patients' families and colleagues to identify potential candidates for surgical intervention. Many patients were well known to local providers due to the need for numerous prior surgical interventions. Photographs were exchanged, and appropriate patients and families were interviewed and examined via Skype, Zoom, or Viber. The considerations to selection were: functional deficit, acuity of need, indicated surgical procedure(s), need for multiple procedures, and comorbidities. In general, we attempted to select patients which required timely surgical intervention and would receive the highest benefit from an operative procedure. Patients with complicated operative needs (hand, breast, or face reconstructions) were deemed favorable as it was unlikely that they would receive care elsewhere. Patients requiring multiple interventions, including staged procedures, were also selected preferentially. We had to be reasonably certain that we could safely perform the required procedure in the given setting, and would be comfortable with follow-up management being conducted by the local team (with telemedicine oversight, if indicated). Finally, caregivers and patients were briefed on COVID-19 preventative protocols and were encouraged to adhere prior to and during the mission. Selecting more surgically complex patients had the added benefit of reducing potential exposure to COVID-19. This, however, came at the cost of treating fewer patients. Overall, we were able to perform 76 procedures on 25 patients; several of these being staged procedures which would require local surgeon follow-up for completion. There were no reported postoperative complications at 1 month.

Another major change that was implemented was canceling traditional outreach clinic patient visits due to the risk of viral exposure. Previously, dozens of patients were seen and triaged in person during the outreach mission. These patients would then be selected for either immediate operative intervention or, more typically, considered for operation during subsequent missions. This facet of the mission was replaced by telemedicine screening which increased reliance on local healthcare providers to aid in patient selection. The process was labor intensive but was spread over several months prior to our arrival. This was an improvement over the traditional in-person clinic which occupied valuable physician time with nonoperative tasks. While streamlining our patient selection process, our team found that access to accurate and concise patient demographics, histories, photographs, and operative plans was essential. This, paired with need for exchange of information between team members, prompted the development of a *de novo* record-keeping system. Although not deployed prior to

Table 1. Patient demographics and procedures

Age	Gender	Number of distinct procedures	Scar release and skin graft	Local tissue rearrangement	Extremity reconstruction	Facial reconstruction	Other complex reconstructive procedure	Procedure
8	M	3		✓	✓	✓		R ear staged reconstruction with pocket flap, z-plasties R neck, z-plasties R arm/hand
4	M	2		✓				Z-plasties R chest, z-plasties R axilla
9	M	3	✓	✓				Release and split-thickness graft chest, z-plasties R axilla, z-plasties R neck
10	M	3	✓	✓				Release and split-thickness graft of L chest, release and split-thickness graft L arm, z-plasties L axilla
15	M	4	✓	✓	✓	✓		Release and full-thickness graft R hand, release and full-thickness graft L ear, z-plasties L axilla, z-plasties L neck
19	F	3	✓	✓	✓			Release and full-thickness graft L foot, k-wire fixation (six wires) of L toes, z-plasties L foot
21	F	4	✓	✓		✓		R ear staged reconstruction with conchal transposition flap, full-thickness graft R ear, z-plasties bilateral nasolabial folds
22	F	3	✓	✓			✓	R breast pedicled nipple transposition, L breast CV flap nipple reconstruction with split-thickness groin graft to areola, release and split-thickness graft abdomen
8	M	3	✓	✓	✓			Release and full-thickness graft R foot, k-wire fixation R great toe, z-plasties L foot
21	M	1	✓	✓	✓			Release and full-thickness graft neck
13	F	5	✓	✓	✓			Release and full-thickness graft L hand, k-wire fixation of digits (3 and 5), extensor tendon reconstruction L middle finger, z-plasties R axilla, z-plasties R chest
21	M	5	✓	✓	✓			Release and split-thickness graft R arm, release and split-thickness graft R hand, release of syndactyly R hand, release and split-thickness graft L hand, release and split-thickness graft L arm
41	M	2	✓	✓				Release and full-thickness graft of R neck, z-plasties R axilla
10	M	3	✓	✓	✓			Release and split-thickness graft chest, z-plasties R wrist, z-plasties L wrist

Table 1. Continued

Age	Gender	Number of distinct procedures	Scar release and skin graft	Local tissue rearrangement	Extremity reconstruction	Facial reconstruction	Other complex reconstructive procedure	Procedure
5	M	5	✓	✓	✓	✓		Z-plastics R finger/hand, z-plastics R axilla, z-plastics L axilla, z-plastics R oral commissure, z-plastics L oral commissure
10	M	3	✓	✓	✓			Z-plastics R axilla, z-plastics L axilla, release and split-thickness graft L axilla
3	M	2		✓	✓			z-plastics L axilla, z-plastics L arm
12	M	3		✓		✓		z-plastics chin, z-plastics lip, z-plastics neck
17	M	2	✓	✓	✓			Release and full-thickness graft R first webspace, release and deepening and full-thickness graft R fourth webspace
15	M	4	✓	✓	✓			z-plastics L arm, release and full-thickness graft L palm, z-plastics L fingers, digital nerve graft
10	M	1				✓		Insertion of scalp tissue expander
7	F	5	✓	✓		✓		z-plastics glabella, z-plastics R nasolabial fold, z-plastics L nasolabial fold, philtrum reconstruction with conchal composite graft, full-thickness graft R ear
18	F	4	✓	✓	✓			z-plastics R arm, R breast reconstruction, R chest release and split-thickness graft, z-plastics L/center chest
2	M	1		✓	✓			L duplicated thumb removal
4	F	2	✓	✓	✓			Release and full-thickness graft L hand, z-plastics L hand and fingers
Total (average or percent total)	F: 7 (28%) M: 18 (72%)	97 (3.04)	18 (22%)	23 (24%)	15 (60%)	7 (28%)	1 (4%)	

L, left; R, right.

the mission, development continues, with an anticipated implementation for the subsequent outreach missions.

Education and Training

We maintained a strong emphasis on education and training, as these components are essential for conducting sustainable outreach missions. This is a critical piece of the horizontal component in diagonal outreach missions which are focused on improving infrastructure and increasing local surgical capacity. Due to the importance of incorporating educational practices, we did not make sacrifices in spite of COVID-19 and rather ensured that education and training were incorporated in all possible aspects of the mission. As this was a new location within Ukraine, training of local staff was essential to ensuring success. The education component began in the months prior to the mission trip where we selected foreign hospital staff and volunteers. Qualifications and skills were screened by our team and numerous training sessions occurred through Zoom. Twelve clinicians and residents (anesthesia, pediatrics, surgery) as well as six nurses (operative room [OR], post anesthesia care unit [PACU], preop) were selected after the initial interview process. Nurses and surgical assistants were trained by our team on case setup, instruments, special equipment, and proper sterile technique. Local medical students provided translation services as well as aided with dressing changes and postoperative care, and were able to observe all surgical procedures. Didactic teaching was provided for all local medical personnel within the hospital, including nurses, medical students, residents, and staff. Considerations in disease reduction were made through mask-wearing, adhering to social distancing recommendations, and requiring vaccination for all attendees. In addition to structured didactic teaching, training was conducted within the operating room and the wards. Three residents from training programs in the United States were able to travel with our group and participate in surgery under the close supervision of the surgical attendings. Local surgeons and senior residents in training programs in Ukraine were able to assist with each procedure as well. This allowed multiple procedures to be carried out simultaneously on each patient. Surgical planning and intraoperative decision making were stressed during each procedure and during postprocedure debriefing. Staged procedures were meticulously discussed with local surgeons such that they felt comfortable completing the planned interventions. This was key in allowing us to perform two-staged ear reconstructions, scalp tissue expansion, and extremity reconstructions requiring k-wire fixation. Our experience with prior missions was typically limited to less complex, single-stage reconstruction due to concern for loss to follow-up and inadequate local experience. All postoperative directions were given to local providers and discussed in a group setting at the end of each day.

Preventing Perioperative Complications

Several steps were taken to reduce the risk of perioperative complications, including implementation of the World Health Organization (WHO) preoperative checklist. We utilized recent consensus recommendations for global short-term surgical missions, including preoperative planning, in-country perioperative patient care, post-trip follow-up, and need for

sustainability.¹¹ Minimizing risk began with appropriate patient selection and preoperative planning. Patients were selected based on need, as above, and evaluated by our surgical team prior to arrival in Ukraine. History and physical exams were performed preoperatively through telemedicine and local contacts. Allergies, prior surgical interventions and complications, and American Society of Anesthesiologist (ASA) classes were of particular importance in this patient population. Preoperative nursing staff was trained in screening and evaluation practices and ensured efficient preoperative preparation. Additional anesthesia support was available at induction for any high-risk patient. Adherence to the 19-point WHO preoperative checklist was mandated.¹² Utilizing these methods, we were able to avoid potential harm due to a discovered anesthesia machine malfunction. We reported a perioperative complication rate of 4%, due to one patient receiving a partial second-degree burn (approximately 6 cm²) from the heated OR table pad. Although initially painful, this child was able to make a full recovery without any need for surgical intervention.

Follow-up

Patients were recommended for several days of inpatient care postoperatively to ensure close monitoring of all surgical sites. Teaching rounds and dressing changes were performed daily with local providers, residents, and medical students in attendance. Additional follow-up took place for all patients at 1 week, 1 month, and 2 months postoperatively. This was done using telemedicine and photo exchange. Patients followed-up with local providers and live video or telephone and photograph exchange was carried out with members of our team. A small number of patients were able to conduct telemedicine follow-up with us without the need for local physician evaluation. These patients were selected based on patient age, perceived involvement and capabilities of caregivers, and surgical intervention performed. We report no postoperative complications at 1-month follow-up. Patients requiring longer follow-up and staged procedures will continue to be followed by similar means. The education and training component was vital in this aspect in order to properly execute these staged procedures.

General COVID-19 Safety Practices

General COVID-19 safety practices were followed as recommended by local and federal governments, as well as the CDC and WHO.^{13,14} Our team members were fully vaccinated and encouraged to obtain a booster dose of the COVID-19 vaccine prior to the start of the outreach. Masks were worn when in proximity with each other, or other individuals. There were several vaccine formulations available; however, the vaccination rate in Ukraine at the time of the mission was estimated to be 10%.¹⁵ Local hospital staff was encouraged to be fully vaccinated prior to our arrival. Patients and caregivers who were eligible for vaccination were required to be fully vaccinated. Only one caregiver was permitted to accompany the patient to the hospital. Patients and caregivers were tested for COVID-19 at 24–48 h prior to surgery. We confirmed with local hospital administration that there were adequate resources available to accommodate our team and our expected

surgical volume. A separate unit of the hospital was dedicated to our patients. Preoperative screening occurred prior to the patients' arrival at the hospital. We report one patient who failed preoperative screening due to cold-like symptoms. The patient was advised to stay home and will be rescheduled for the following year.

Testing practices for returning to the USA were followed by our team, which included negative COVID-19 testing no more than 72 h prior to departure to the USA. Even with appropriate vaccination, testing, and social distancing precautions, there remains a risk of infection. One of our team members developed symptoms of COVID-19 7 days after returning to the United States. Although, it is difficult to know with certainty where the infection was acquired, timing suggests that exposure occurred during the return flight, or shortly afterwards. Appropriate quarantine techniques were followed, and the individual was cleared to return to clinical duties 1 week later.

CONCLUSION

We applied a variety of protective strategies and altered mission protocol to limit exposure and transmission while focusing heavily on education and training. We increased operative complexity to increase impact while limiting patient exposure. Additionally, we increased the use of telemedicine and eliminated typical in-person clinic visits. Rigorous perioperative safety and follow-up protocols were implemented.

We recognize that each situation will call for a uniquely tailored approach due to mission objectives, size, foreign infrastructure, COVID-19 prevalence, and testing and vaccination availability. This mission was carried out when the Delta variant was the most prevalent. Newer COVID-19 variants such as Omicron present other challenges, including increased asymptomatic cases, increased ease of spread, and higher rate of breakthrough cases in vaccinated individuals. Assuredly, the Omicron variant tends to produce less severe symptoms.¹⁶ Organizers should be prepared for cancellations and scheduling changes due to the rapidly evolving nature of the pandemic. As novel therapies including monoclonal antibody prophylaxis¹⁷ and variant specific vaccinations¹⁸ arise, well-planned outreach missions will continue to play a role in reducing the global burden of disease. Risk-to-benefit analysis should be thoroughly evaluated and consensus between mission and local providers and regulatory bodies should be established prior to resuming any global surgical initiative.

Our approach to reengaging in short-term global surgical missions was successfully executed and is intended to serve as guidance to other missions. The improvements to our outreach protocols, including heavy reliance on telemedicine, both as a tool for triage, as well as follow-up, have been instrumental to our success. In addition, telemedicine played a valuable role in training and education of local staff, improving

efficiency and patient safety. Though global outreach missions are not strangers to the utilization of telemedicine, the COVID-19 pandemic has forced a rapid implementation of this technology. These changes we have discussed are likely to become the standard of future missions, extending beyond the duration of the pandemic.

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