Our Experiences with Plastic and Reconstructive Surgery Procedures during Coronavirus Disease 2019 Pandemic

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Background: The novel Coronavirus Disease 2019 (COVID-19) has rapidly become a health threat worldwide and has been declared global pandemic by the World Health Organization. Possible transmission routes, including respiratory droplets, close contact, and aerosol propagation, have put plastic and reconstructive health-care professionals at high risk, especially during surgical procedures. The aim of this study was to summarize and share our experience of infection control measures and corresponding outcomes during the COVID-19 pandemic.

Methods: Infection control measures, including workflow optimization, useful epidemiologic survey methods, and personal full protective clothing, were discussed. Characteristics and outcomes of emergency cases and elective cases under local and general anesthesia during the COVID-19 pandemic were summarized.

Results: A hierarchy of interventions were applied mainly from 4 aspects. First, administration control and online consultation significantly decreased patient attendance. Second, a triage workflow was established to identify high-/low-risk patients, with clinical manifestations (fever, fatigue, cough, nasal discharge, etc), epidemiologic survey, blood test, chest computed tomographic scan, and coronavirus test if necessary. Third, strict environmental control was adopted using increasing ventilation, isolated room for inpatients, etc. Fourth, proper rotation of healthcare staff was ensured to reduce workload and minimize possible contact. A total of 904 emergency interventions, 2561 local anesthesia, and 570 general anesthesia were performed during this period, and none of the cases/healthcare professionals were found to be infected.

Conclusions: Our experience could help global plastic and reconstructive health-care professionals to get better preparation and continue to give qualified medical services during the COVID-19 pandemic. Proper adjustments should be taken according to their own clinical settings. (Plast Reconstr Surg Glob Open 2020;8:e2868; doi: 10.1097/GOX.0000000000002868; Published online 13 May 2020.)

INTRODUCTION
Since the end of December 2019, the outbreak of a novel coronavirus, named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), began in Wuhan, China, and caused severe pneumonia [Coronavirus Disease 2019 (COVID-19)]. Since then, COVID-19 has become an increasingly serious global public health concern. SARS-CoV-2 virus is highly contagious and causes severe pneumonia in vulnerable populations. Moreover, not only confirmed COVID-19 patients but also asymptomatic carriers are sources of infection, which creates huge challenges for infection control. Chinese government and healthcare professionals took strict measures to control the spread and rescue the infected. Currently, the pandemic in China is greatly under control compared with the situation 1 month ago. However, as of March 31, 2020,
the infection has spread to >160 countries, and >800,000 cases have been confirmed worldwide, with over 40,000 total deaths. Therefore, on March 11, 2020, the World Health Organization (WHO) declared the infection to be a global pandemic, indicating the severity of the worldwide involvement of the disease.

The transmission routes of COVID-19 include respiratory droplets and close contact. Recently, possible aerosol propagation has also been proposed, which is implicated as a worrisome problem for our plastic and reconstructive healthcare professionals, as we are usually exposed to high concentration of aerosols for a long time in a relatively airtight environment during procedures, especially for microsurgeries and procedures related to craniofacial regions. In addition, most plastic and reconstructive healthcare professionals are subspecialized and do not cope with contagious infections for a long time during their training program. This inadequate experience further increased the risk for infections. However, the scheduled treatments could not be cancelled or postponed totally and immediately when the epidemic started. Not to mention, emergency injury and trauma cases are the inescapable responsibilities for healthcare professionals in the Plastic and Reconstructive Surgery (PRS) department.

Sadly, merely in China, as of February 24, WHO-China Joint Mission announced that there were up to 3387 healthcare workers infected with COVID-19, with 22 deaths. The situations above have made PRS-related treatments “high-risk” procedures during this pandemic. To reduce the risk of transmission, some hospitals in China have stopped PRS-related approaches. However, this would cause delay in treating life-threatening situations, like skin and soft-tissue cancer, emergency injury, and trauma. Therefore, as the largest PRS center in China, it is our responsibility to continue medical services, but how to carry out necessary PRS procedures with doctors and patients well protected is a question of top priority at present. This is a currently emerging problem challenging PRS healthcare professionals worldwide.

Herein, we attempt to summarize our experiences in the aspects of administration control, workflow, environmental control, and staff protection during the COVID-19 pandemic based on our institutional collection of over 4000 cases with reference to recent WHO and Chinese guidelines. We want to share our Shanghai Ninth People’s experience with worldwide PRS colleagues to fight against the novel coronavirus, and meanwhile, proceed with our procedures safely.

METHODS

Summarization of Measures

Effective infection control measures in the Department of Plastic and Reconstructive Surgery, Ninth People’s Hospital, Shanghai Jiao Tong University School of Medicine, were summarized and discussed. Included measures were discussed from 4 aspects: (1) administration control and online consultation; (2) establishment of a triage workflow; (3) strict environmental control; and (4) staff protection. Related useful documents were translated into English, which could be used for reference and be of benefit for further development.

Cases and Procedures

We systematically summarized all available data regarding cases and procedures performed during the pandemic from January to March 2020, including PRS emergency cases and elective cases under local or general anesthesia. In addition, we also mentioned the infection outcomes of patients and healthcare professionals during this period.

RESULTS

Administration Control and Online Consultation

This is the first step and most effective way in the pandemic hierarchy responses, which significantly decrease the number of patients’ and relatives’ accumulation in clinical settings. Public announcements were made by way of introduction in hospital and department websites to advise normal people against visiting hospital without notice. Scheduled visits of patients were contacted by surgeon/nurse-in-charge to explain the current situation and try to reschedule appointments. Multiple contacts were made available to each rescheduled patient to help them keep in touch in case of emergency.

With a daily attendance of over 1000 patients in outpatient clinic and over 200 in inpatient clinic, this measure significantly reduced the number of patient attendance. In addition, patients decreased the risk of transmission not only in the hospital but also in the traffic, hotel, and many other public areas and facilities. Fifty-six percentage of attendance was reduced using this approach. Since this measure was taken from early January 2020 and the epidemic became serious in February, all of the non-urgent elective procedures under local anesthesia were suspended or rescheduled and the local anesthesia operation room was closed during February 2020 to minimize the risk of infection.

Due to the characteristics of PRS practice, online consultation with video between patients and doctors was provided as an alternative option. By direct communication with PRS healthcare professionals with visual interactions, most patients felt satisfied with the additional service by doctors. Patient–physician relationship and mutual understanding/trust were not affected by lack of face-to-face talks.

Establishment of a Triage Workflow

The triage workflow was established (Fig. 1). Careful review of indications and following the workflow are crucial to save life-threatening conditions without unnecessary increased risk of infection.

Because up to 98% of COVID-19–infected cases presented with fever, it is vital to identify fever patients before they enter hospital. All patients and companions were screened using infrared thermometers. Once patients with fever were detected, they would be referred to fever clinic immediately for consultation and medical treatments.

At PRS department reception, the patients and companions should be reconfirmed with potential COVID-19 symptoms (fever, fatigue, cough, nasal discharge, etc) and possible
An epidemiologic survey should be filled out with complete contact information for potential contact tracing if the infection (or presumptive infection) occurs. (See questionnaire, Supplemental Digital Content 1, which displays the aim of this study. The aim is to summarize and share Shanghai Ninth People’s Hospital PRS department’s experience of infection control measures and corresponding outcomes during the COVID-19 pandemic, http://links.lww.com/PRSGO/B389). Chest computed tomographic tests are routinely performed for each inpatient, and coronavirus blood test would be performed if infection was suspected.

Suspected cases would be rescheduled if their conditions were not urgent. The 2-week quarantine was a basic requirement, before a second-time evaluation. Medical advice, treatments, and close follow-ups were provided. All emergency cases were treated as suspect cases with special caution because PRS procedures usually began before results of infection detection were available.

Environmental Control Measures

The purpose of environmental control was to prevent the spread and reduce the risk of nosocomial infection. Air ventilation in waiting rooms, outpatient clinics, and wards was enhanced via opening windows or increasing workload of air refreshing equipments. Disposable handkerchiefs and free alcohol swabs were provided for both healthcare professionals and patients at convenient places. Single-use bed sheets and disposable gowns/drapes were highly recommended. Patients were required to wear a mask during transfer between ward and operation room. Intubation and extubation were managed by the most experienced anesthetists with full set of personal protection equipment to shorten time and increase success rate. A thorough preoxygenation with 100% oxygen and rapid sequence induction were performed to avoid manual ventilation of the patient, which might result in aerosolization of virus from airways. Only 1 or 2 doctors and 1 nurse were allowed in 1 operation room, depending on the degree of complexity of the procedure involved. All sheets, gowns, and drapes would be collected and put into a special bag attached with name tag inside the operation room. In addition, the operation room would be disinfected using ultraviolet lights for at least 30 minutes before the next operation. Patients were placed in isolated room in inpatient ward if possible. If not, at most 2 patients were arranged in the same room.

Staff Protection Measures

The close proximity between PRS healthcare professionals and patients puts PRS healthcare professionals at high risk of infection, and the risk is even higher in those who operate in craniofacial regions. The staff should be equipped with adequate protection against the infection. When contacting afebrile and unsuspected patients, medical staff should wear a surgical mask or N95 mask, working cap, disposable waterproof protective suit, gloves, shoe covers, and goggles/facial screens. Isolation screens should be added when performing on emergency cases and patients with general anesthesia, which usually lasted for a relatively long time.

Procedures for suspected COVID-19 cases should be performed in operation rooms with negative pressure. Procedures for confirmed COVID-19 cases should be performed in designated institutions for centralized treatment of COVID-19 patients.

Patients should also be well protected. As regard to those patients receiving procedures not related to craniofacial areas, surgical mask should be worn during the whole process. For patients receiving procedures related to facial regions, a sterilized gauze is placed over mouth and nose to prevent respiratory droplets from spreading. During the procedure, all oral communication including doctor–nurse and doctor–patient communication should be limited only to the most necessary talk.

Summarization of Cases and Procedures during COVID-19 Pandemic

During the COVID-19 pandemic, although the workload was significantly decreased and all possible efforts were taken to reschedule non-urgent cases and procedures, there were

Table 1. Summarization of Emergency Cases in PRS Department during the COVID-19 Pandemic

| Area, n (%) | January | February | March |
|------------|---------|----------|-------|
| Face and neck | 367 (90.62) | 199 (91.28) | 256 (91.10) |
| Arms | 38 (9.38) | 16 (7.34) | 21 (7.47) |
| Others | 0 | 3 (1.38) | 4 (1.42) |
| Surgical type, n (%) | | | |
| Facial debridement | | | |
| >6 y old | 326 (80.49) | 178 (81.65) | 223 (79.36) |
| ≤6 y old | 41 (10.12) | 21 (9.63) | 33 (11.74) |
| Hand debridement | 38 (9.38) | 16 (7.34) | 21 (7.47) |
| Others | 0 | 3 (1.38) | 4 |
| Total, n | 405 | 218 | 281 |
still over 4000 procedures performed. Demographic characteristics of patients and surgical procedures–related parameters are summarized in Tables 1–3. The emergency cases were mildly increased due to the temporary suspension of medical services in PRS departments in some other hospitals. From the tables, it is observed that the measures taken significantly decreased the number of patients in February compared with that in January. All non-urgent elective cases with local anesthesia in February 2020 were successfully rescheduled. All patients who received treatments in PRS department would be followed 14 days after the visit or discharge from hospital to detect potential infection or coronavirus carrier. Till March 19, no infection of patients and PRS healthcare professionals was reported in our department.

Currently, because the COVID-19 pandemic is already under control in China, the medical service in our PRS department started to return to routine practice with great caution step by step.

**CONCLUSIONS**

In conclusion, although plastic and reconstructive procedures are relatively “high-risk” procedures during the COVID-19 pandemic, it is thought to be an unwise or even irrational decision to stop all PRS-related visits and treatments for avoiding all the potential risks. Emergency cases related to our field would be required to be dealt with, and such scenarios could not all be prevented, especially for trauma. Therefore, shutting off all surgical procedures might not be a suitable solution, and at least PRS emergency service should not be stopped. It is the professional responsibility of plastic and reconstructive healthcare professionals to save lives, salvage the damaged tissues or limbs, and alleviate the sufferings of the patients including pain.

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**Table 2. Summarization of Local Anesthesia Cases in PRS Department during the COVID-19 Pandemic**

|                  | January | February | March  |
|------------------|---------|----------|--------|
| **Sex, n (%)**   |         |          |        |
| Male             | 288 (14.36) | 0 | 58 (10.43) |
| Female           | 1717 (85.64) | 0 | 498 (89.57) |
| **Age, n (%)**   |         |          |        |
| <20              | 325 (16.21) | 0 | 43 (7.73) |
| 20–50            | 1529 (76.26) | 0 | 445 (80.03) |
| >50              | 150 (7.48) | 0 | 68 (12.23) |
| **Area, n (%)**  |         |          |        |
| Face and neck    | 1554 (77.51) | 0 | 478 (85.97) |
| Arms             | 60 (2.99) | 0 | 15 (2.70) |
| Trunk            | 28 (1.40) | 0 | 25 (4.13) |
| Others           | 363 (18.1) | 0 | 40 (7.19) |
| **Surgical type, n (%)** | | | |
| Injection        | 839 (41.85) | 0 | 321 (57.73) |
| Cosmetic surgery | 475 (23.69) | 0 | 101 (18.17) |
| Ophthalmic surgery |          | | |
| **Tumor resection** | 294 (14.66) | 0 | 25 (4.50) |
| Rhinoplasty      | 89 (4.44) | 0 | 14 (2.52) |
| Others           | 308 (15.36) | 0 | 97 (17.09) |
| **Total**        | 2005 | 0 | 556 |

**Table 3. Summarization of General Anesthesia Cases in PRS Department during the COVID-19 Pandemic**

|                   | January | February | March  |
|-------------------|---------|----------|--------|
| **Permanent residence, n (%)** |         |          |        |
| Shanghai          | 89 (19.43) | 4 (17.4) | 23 (25.84) |
| Other provinces   | 369 (80.57) | 19 (82.6) | 66 (74.16) |
| **Sex, n (%)**    |         |          |        |
| Male              | 160 (34.93) | 3 (13.04) | 12 (12.48) |
| Female            | 298 (65.07) | 20 (86.96) | 77 (87.52) |
| **Age, n (%)**    |         |          |        |
| <20               | 234 (51.69) | 5 (21.74) | 26 (29.21) |
| 20–50             | 196 (42.79) | 1 (4.35) | 63 (70.79) |
| >50               | 28 (6.11) | 0 | 0 |
| **Marriage, n (%)** |         |          |        |
| Unmarried         | 347 (75.76) | 14 (60.87) | 31 (34.83) |
| Married           | 106 (23.14) | 9 (39.13) | 58 (65.17) |
| Divorced          | 5 (1.09) | 0 | 0 |
| **Area, n (%)**   |         |          |        |
| Face and neck     | 207 (45.2) | 15 (65.22) | 47 (52.81) |
| Arms              | 20 (4.37) | 0 | 13 (14.61) |
| Trunks            | 52 (11.35) | 2 (8.7) | 6 (6.74) |
| Others            | 179 (39.08) | 6 (26.09) | 23 (25.84) |
| **Main complaints, n (%)** |         |          |        |
| Cosmetic improvement | 102 (22.27) | 9 (39.13) | 9 (10.11) |
| Congenital malformation | 99 (21.6) | 3 (13.04) | 13 (14.61) |
| Scar              | 72 (15.72) | 0 | 15 (16.85) |
| Pigmented nevus   | 47 (10.26) | 0 | 9 (10.11) |
| Reoperation       | 40 (8.73) | 7 (30.43) | 4 (4.49) |
| Superficial tumor | 25 (5.46) | 1 (4.35) | 21 (23.60) |
| Vascular malformation | 25 (5.46) | 1 (4.35) | 17 (19.10) |
| Others            | 48 (10.48) | 2 (8.7) | 1 (1.12) |
| **Operation classification, n (%)** | | | |
| Class I–II        | 92 (21.70) | 10 (45.45) | 10 (11.24) |
| Class III–IV      | 274 (64.62) | 12 (54.55) | 79 (88.76) |
| **Hospital stay (d), n (%)** | | | |
| ≤3                | 155 (33.84) | 10 (45.48) | 11 (12.36) |
| 3–7               | 224 (48.91) | 12 (52.17) | 64 (71.91) |
| >7                | 79 (17.25) | 1 (4.35) | 14 (15.73) |
| **Prognosis, n (%)** |         |          |        |
| Cure              | 314 (68.56) | 13 (56.52) | 73 (82.02) |
| Improvement       | 113 (24.67) | 10 (43.48) | 16 (17.98) |
| Others (including uncured) | 31 (6.77) | 0 | 0 |
| **Total, n**      | 458 | 23 | 89 |
Instead, a careful balance between potential risk of infection and continuing medical service should be established with comprehensive hierarchy measures. During the pandemic, strict epidemiologic survey and differential diagnosis of fever would be crucial. With adequate protection installed, PRS procedures could be safe and effective.

A clear and concise workflow was helpful for the safe and effective performance of PRS department. Infection protection should be given to both healthcare professionals and patients. Meanwhile, close attention should be paid to the trend of the pandemic, and the way of restrictions on indications could be gradually mitigated to satisfy the medical demand during this special difficult period.

Because the COVID-19 pandemic seems to be becoming increasingly worse outside of China currently, we hope our valuable experience could help global plastic and reconstructive healthcare professionals to get better preparation and continue to give qualified medical services during the COVID-19 pandemic. Due to variations in pandemic severity and specific department settings in different hospitals and countries, we really recommend our PRS colleagues to collaborate with their local colleagues, doctors in other medical specialties, and all levels of governments to fight against this pandemic, prevent its transmission, and reduce potential damage.

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