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RESEARCH ARTICLE

The Decline in the Number of Plastic Surgeries Under the Novel Coronavirus Epidemic in Japan Was Attributed to the Decline In Patients with Acute Diseases such as Trauma and Malignant Tumors

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3. literature research; Masaki Fujioka.
4. clinical studies; Masaki Fujioka, Kiyoko Fukui, Marie Idemitsu, and Kentaro Yoshino.
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ABSTRACT

[Introduction] Since the first infected person was confirmed in Japan on January 15, 2020, the novel coronavirus has become a serious crisis management issue, and people's lifestyles have changed significantly. We examined how plastic surgery patient trends have changed over the past three years of the COVID-19 epidemic. Methods: We compared the average number of surgical patients during the five years before the outbreak of COVID-19 and the number of cases during the epidemic (January 2020-December 2022). In addition, we classified the surgeries performed during this period into acute-stage diseases (trauma, malignant tumors, acute infections) and non-acute-stage diseases (chronic ulcers, benign tumors, congenital anomalies), and examined changes in surgical tendencies. Due to the COVID-19 epidemic during this time, the period during which surgery was recommended to be postponed was approximately 340 days. [Results] While the number of surgeries in all departments decreased significantly (-6.2%), the number of plastic surgeries decreased by 13.2%. Comparing the acute disease group and non-acute disease group, there was no significant change in the non-acute disease group, while the acute disease group showed a significant decrease of -17.8%. In particular, surgery for trauma decreased significantly by -18.2%, and surgery for malignant tumors

decreased by -25.4%. The decrease in injuries is considered to be related to the fact that the number of traffic accidents in 2020-2021 was the lowest on record, and that the number of injuries was on a downward trend nationwide due to the COVID-19 epidemic. The decrease in malignant tumors is considered to be related to the 30-50% decrease in the number of people undergoing health checkups in 2020-2021. [Conclusion] 1. The number of plastic surgeries has decreased compared to before the COVID-19 epidemic. 2. The number of surgeries in the acute disease group decreased significantly, and the decrease in the number of surgeries for trauma and malignancies was marked. 3. Even during the COVID-19 epidemic, the impact on the decrease in the number of surgeries was less pronounced in the second half.

Keywords: novel coronavirus infection, COVID-19, plastic surgery, surgical restrictions, surgery statistics

Introduction

In Japan, the first novel coronavirus (COVID-19) patient was diagnosed in February 2020. As of February 2023, three years later, there have been eight outbreaks of COVID-19. As a result, the

number of people infected with COVID-19 increased in geometric progression to 232,000 in 2020, 1,495,000 in 2021, and 274,844,000 in 2022. (Figure 1) ¹⁾

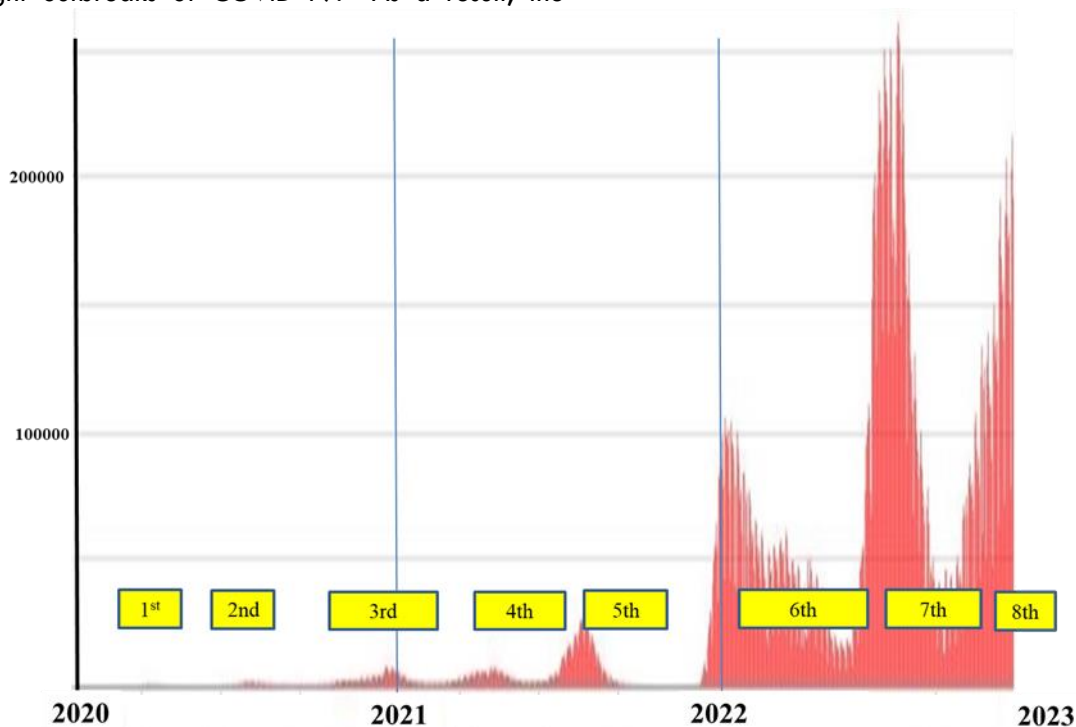


Figure 1. Changes in COVID-19 Newly Infected Patients in Japan in 2020-2022

Central and local governments called for behavioral restrictions (stay-at-home (SAH) order) during these periods during the two-and-a-half-year period until mid-2022, when waves 1-6 were epidemic. They also requested that medical institutions postpone non-urgent scheduled surgeries based on the "Basic Policy for

COVID-19 Countermeasures. Since the SAH order period is issued by the local government, there is a range, but it was about 340 days in Japan^{2,3)}.

Despite public health measures such as vaccination, the COVID-19 epidemic has not stopped, and the number of infected people

continues to rise. The lifestyle of the general public has been forced to change significantly, and it is conceivable that this is prompting changes in the state of surgical consultations.

In such an environment, it is essential to analyze the current state of medical care in preparation for the so-called "with-corona" or "after-corona" era⁴⁾.

In this paper, we compare plastic surgery trends during the COVID-19 epidemic for the three years from 2020 to 2022 with those before the COVID-19 epidemic, and report changes and trends in diseases necessitating surgery.

Method

National Nagasaki Medical Center has 643 beds and is an advanced comprehensive medical facility that plays the role of a regional core hospital. In order to respond to the increase in emergency hospitalized patients due to the COVID-19 epidemic from 2020 to 2022, part of the intensive care unit and two general wards were converted into a dedicated COVID-19 ward to actively accept patients. The Department of Plastic Surgery is run by staff members four, including three specialists, and performs 800-900 surgeries annually.

In this paper, we calculated the monthly total number of surgeries and number of plastic

surgeries in our hospital for the three years from January 2020 to December 2022 after the COVID-19 epidemic, respectively, from medical records. We compared these data with the mean number of surgeries during the same period over the past 5 years to examine the impact of the COVID-19 epidemic on plastic surgery.

Out of the three years, the period during which surgical restrictions were requested due to medical resource shortages was 340 days. Furthermore, we divided the target diseases into an acute disease group (trauma, malignant tumor, acute soft tissue infection) and a non-acute disease group (benign tumor, chronic ulcer, congenital malformation), and analyzed the impact of the COVID-19 epidemic on the number of surgeries for each group.

Results

(1) Changes in the total number of surgeries (Fig. 2, Table 1)

The monthly average number of all surgeries during the COVID-19 epidemic period (January 2020 to December 2022) was 409.3, which showed a significant decrease of -6.2% compared with the monthly average number of surgeries of 436.4 in the five years (2015-2019) before the COVID-19 epidemic ($p=0.003$, Mann-Whitney U test).

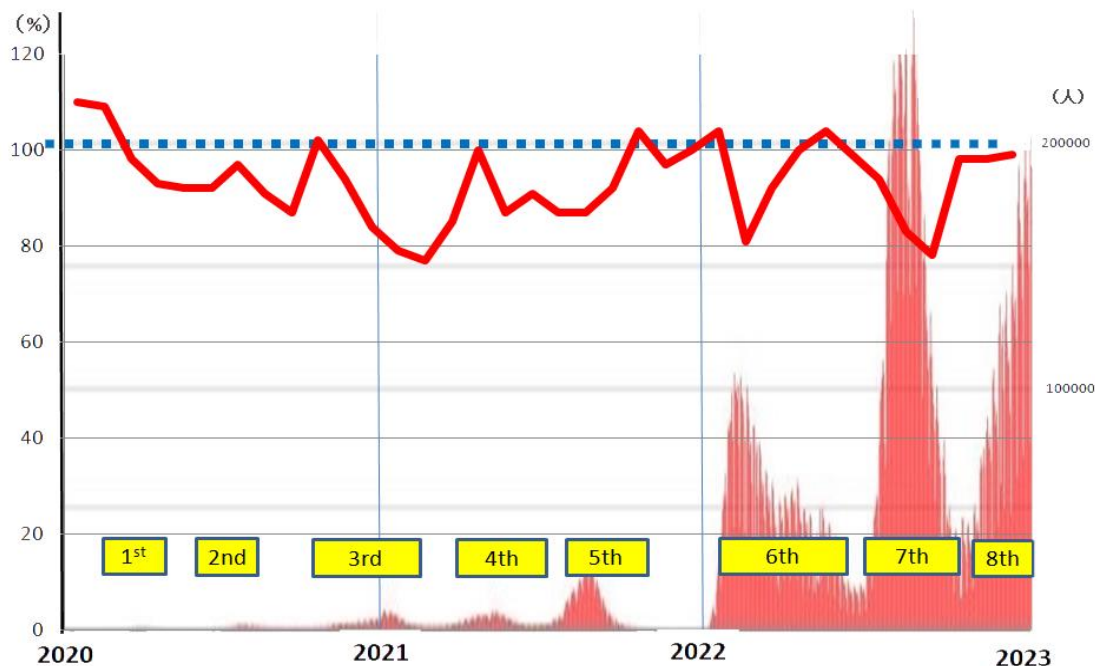


Figure 2. Percentage of surgeries during the COVID-19 epidemic with the total number of surgeries before the COVID-19 epidemic set as 100

	Before or during the COVID-19 epidemic	Average number of surgeries per month	Standard deviation	p-Value (Mann-Whitney U test)
Surgeries in all departments	Before the COVID-19 epidemic	436.4	23.4	0.003
	COVID-19 epidemic period	409.3	39.1	
Surgeries in plastic and reconstructive surgery departments	Before the COVID-19 epidemic	62.8	6.3	0.003
	COVID-19 epidemic period	54.5	12.4	

Table 1. Average number of surgeries per month before and after the COVID-19 epidemic

(2) Changes in the number of surgeries performed by plastic surgery departments (Fig. 3, Table 1) During the COVID-19 epidemic, the monthly average number of plastic surgeries was 54.5, a

significant decrease of -13.2% compared with the monthly average of 62.8 for the five years before the COVID-19 epidemic ($p= 0.003$, Mann-Whitney U test).

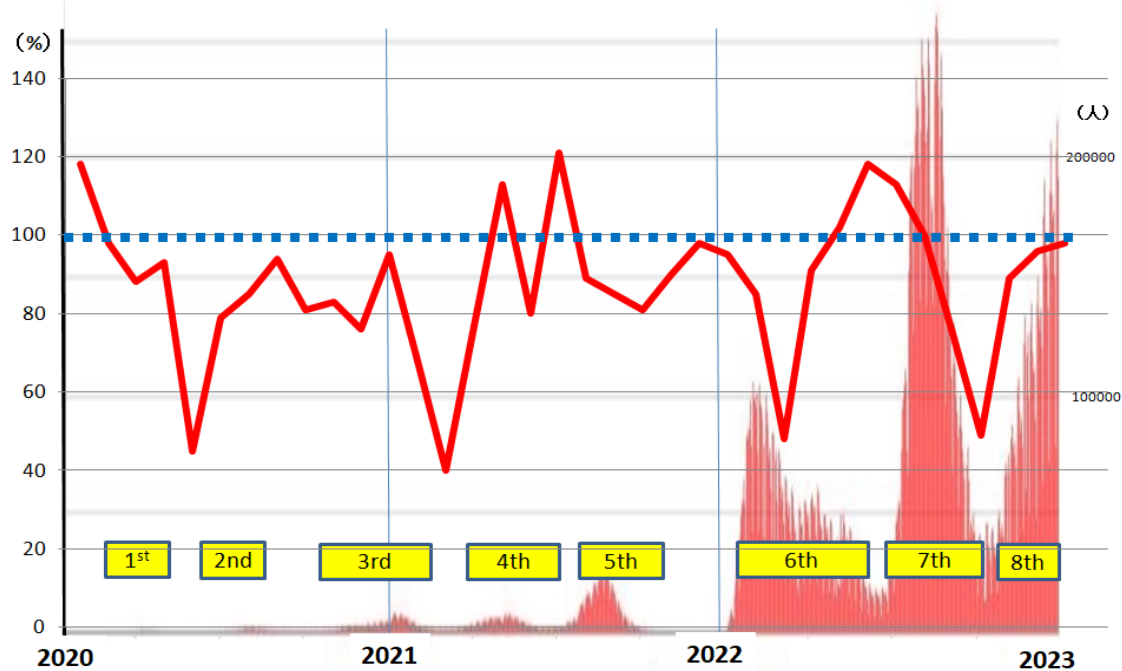


Figure 3. Percentage of plastic surgeries during the epidemic period with the number of plastic surgeries before the COVID-19 epidemic set as 100

(3) Changes in the number of plastic surgeries during the Covid-19 epidemic (Fig. 4) The number of plastic surgery cases during the five years before the COVID-19 epidemic was compared with that during the COVID-19 epidemic in 2020, 2021, and 2022. The average monthly number of surgeries before the COVID-19 epidemic was 62.8 (± 6.4 standard deviations, SD). In 2020, the first year of the COVID-19 epidemic,

it decreased by 16.6% to 52.4 (± 11.5 SD), decreased by 14.0% to 54.0 (± 13.1 SD) in 2021, and decreased by 12.9% to 55.2 (± 13.1 SD) in 2022. In 2020 and 2021, it decreased with a significant difference compared with before the COVID-19 epidemic (2020, $P = 0.003$, 2021, $p = 0.034$, Mann-Whitney U test). The degree of reduction in the number of surgeries decreased with age.

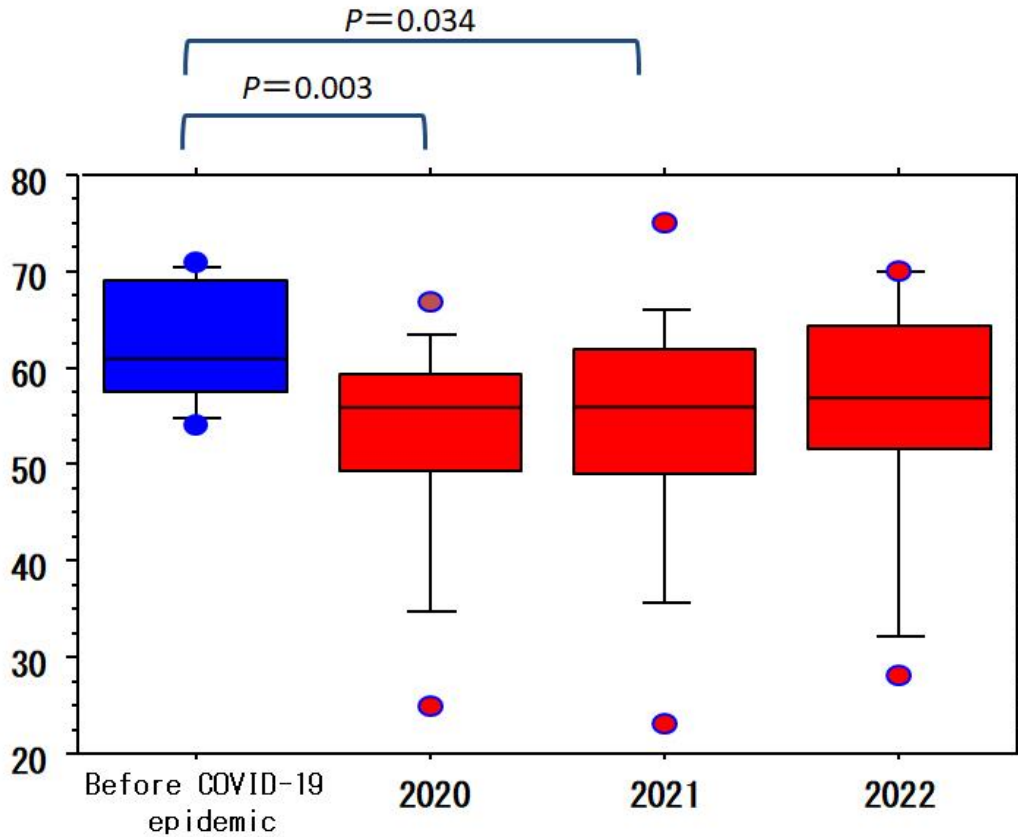


Figure 4. Changes in the number of monthly average plastic surgeries during the COVID-19 epidemic

(4) Comparison of the number of surgeries for acute and non-acute diseases in plastic surgery (Table 2, Figures 5 and 6)

In the acute disease group, the number of surgeries significantly decreased by 17.8% during the 3-year period of the COVID-19 epidemic

compared with before the epidemic ($p < 0.001$, Mann-Whitney U test). The number of surgeries in the non-acute disease group also decreased by -3.6%, but there was no significant difference compared with before the epidemic ($p = 0.55$, Mann-Whitney U test).'

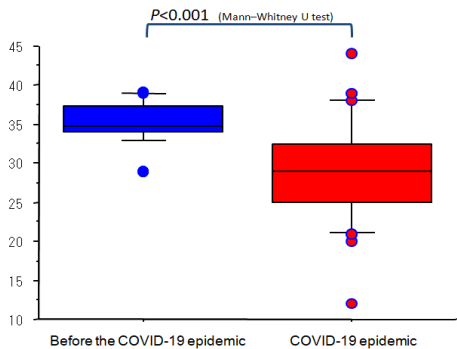


Figure 5. Comparison of the number of plastic surgeries for acute diseases before and after the COVID-19 epidemic

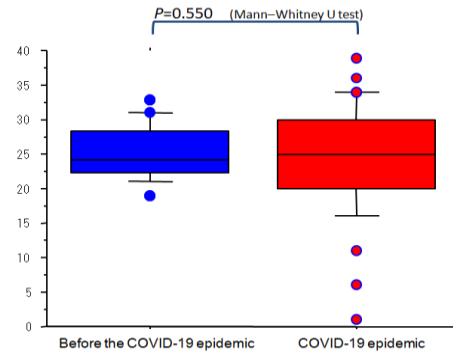


Figure 6. Comparison of the number of plastic surgeries for non-acute diseases before and after the COVID-19 epidemic

	Before or during the COVID-19 epidemic	Average number of surgeries per month	Standard deviation	p-Value (Mann-Whitney U test)
Acute diseases	Before the COVID-19 epidemic	35.3	2.8	<0.001
	COVID-19 epidemic period	29.0	6.4	
Non-acute diseases	Before the COVID-19 epidemic	25.3	4.1	0.550
	COVID-19 epidemic period	24.4	8.2	

Table 2. Average number of plastic surgeries per month for acute and non-acute diseases before and after the COVID-19 epidemic

(5) Comparison of number of surgeries by disease (Table 3, Figures 7, 8)

The number of surgeries by disease in the field of plastic surgery was -25.4% for malignant tumors and -15.8% for trauma, which significantly decreased the number of surgeries compared with that before the COVID-19 epidemic (Malignant tumor $p=0.001$, trauma $p=0.002$, Mann-Whitney U test).

The average increase/decrease in the number of surgeries in other disease groups was: acute bone and soft tissue infection -10.3%, benign tumor -4.2%, chronic ulcer +4.2%, and congenital anomaly +13.5%, showing no significant difference in the number of surgeries compared with that before the COVID-19 epidemic.

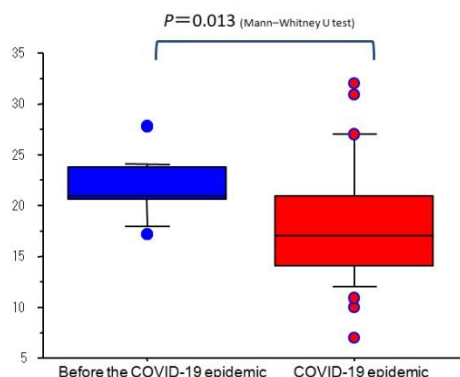


Figure 7. Comparison of monthly average number of trauma surgeries before and after the COVID-19 epidemic

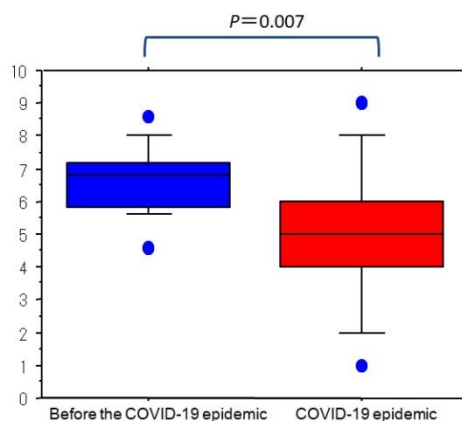


Figure 8. Comparison of monthly average number of malignant tumor surgeries before and after the COVID-19 epidemic

Acute or non-acute	Disease	Before or during the COVID-19 epidemic	Average number of surgeries per month	Standard deviation	p-Value (Mann-Whitney U test)
Acute disease group	Injury	Before the COVID-19 epidemic	21.5	2.5	0.002
		COVID-19 epidemic period	18.1	4.7	
	Acute bone and soft tissue infection	Before the COVID-19 epidemic	6.8	1.3	0.131
		COVID-19 epidemic period	6.1	4.7	
Non-acute disease group	Malignant tumor	Before the COVID-19 epidemic	6.7	1.0	0.001
		COVID-19 epidemic period	5.0	2.2	
	Benign tumor	Before the COVID-19 epidemic	14.3	3.4	0.695
		COVID-19 epidemic period	13.7	5.8	
Non-acute disease group	Chronic ulcer	Before the COVID-19 epidemic	7.1	1.1	0.537
		COVID-19 epidemic period	7.4	3.1	
	Congenital anomaly	Before the COVID-19 epidemic	3.7	1.6	0.349
		COVID-19 epidemic period	4.2	2.5	

Table 3. Number of surgeries by disease before and during the COVID-19 epidemic

Discussion

Since the declaration of the COVID-19 pandemic by the World Health Organization on 12th March, 2020, various surgical departments worldwide were forced to stop or postpone elective surgeries to save the health resources for COVID-19 patients^{5, 6}. Three years after the start of the COVID-19 epidemic, there have been

reports from surgical and anesthesiology departments that the number of surgeries has decreased due to the impact of restrictions on the number of surgeries following the declaration of a state of emergency^{7, 8}.

One of the significant issues was an important decrease in the number of surgeries performed even in countries with highly efficient medical

systems, Brunner M. conducted a survey of 112 colorectal surgeons in Germany during the COVID-19 pandemic and reported that 34% of colorectal cancer patients had to reduce the number of surgeries.^{7, 9, 10} Cano-Valderrama O. et al. reported significantly fewer laparoscopic surgeries in the pandemic era¹¹. It was estimated that during the 12 weeks of peak disruption due to the COVID-19 pandemic, about 28.4 million surgeries would be canceled worldwide, which would require 45 weeks to clear the backlog of surgeries¹². During the COVID-19 pandemic, there were cases where surgeons were assigned to treat respiratory COVID-19 infections, which is outside their specialty. There are also reports that such duties have had a negative impact on the physical and mental health of surgeons¹³. Head and neck surgeons are at the highest risk of exposure to COVID-19 and pose a greater risk to their mental health. Civantos et al. surveyed 163 head and neck surgeons and found that symptoms of anxiety, distress, burnout, and depression were reported in 74 (45.5%), 43 (26.3%), 24 (14.7%), and 26, (16.0%)¹⁴. All surgical services have thus been severely impacted during this ongoing COVID-19 pandemic, and this has become a serious concern for both surgeons and patients requiring surgery.

While the number of surgeries in all surgical fields is decreasing, head and neck surgeries and limb hip joint surgeries have had a large impact, and there are reports of a 30% reduction in otorhinolaryngology surgeries in particular^{15, 16}. The COVID-19 epidemic also had a large impact on plastic surgery, with which many patients receive treatment for the head, neck, and limbs. In 2020, there was a report of a 21.6% reduction in the number of surgeries in the field of plastic surgery compared with the number before the COVID-19 epidemic¹⁷. In our survey, the number of plastic surgeries decreased to -13.2% during the COVID-19 epidemic. The plastic surgery field appeared to be more strongly affected by the COVID-19 epidemic compared with the -6.2% of all surgical procedures.

The number of people infected with COVID-19 increased geometrically in the second and third years, but the number of plastic surgery patients was the lowest in 2020, the first year of the epidemic, and a recovery trend has been observed since then¹⁸. Also, there was no significant difference compared with the number of surgical patients before the epidemic in 2022, which showed that the influence on the control of the

number of surgeries decreased as time passed from the outbreak of the first epidemic. We initially considered that the reason for these declines in the number of surgeries was that patients with non-acute diseases who did not need to undergo surgery in a hurry postponed their surgeries or refrained from visiting hospitals themselves. Ozturk et al announced that care for trauma and malignancy must continue even under the COVID-19 epidemic¹⁹. However, it was found that the number of surgeries in the non-acute disease group, in which patients could wait, showed a smaller decrease, while that in the acute disease group, requiring immediate surgery, decreased significantly. Furthermore, regarding the acute disease groups, the number of surgeries for malignant tumors and trauma showed a significant reduction.

As these two diseases were less susceptible to surgical restraint recommendations during the COVID-19 epidemic, these decreases represent a reduction in disease incidence. With regard to trauma, there has been a significant change in the incidence of traffic accidents in Japan. In the five-year period of 2015-19 before the COVID-19 outbreak, the average number of traffic accident injuries was over 570,000. However, this number has decreased annually, and the average number of injured people for the three years from 2020 to 2022 was about 360,000, revealing that the number of traffic accident injuries has decreased by 37% during the COVID-19 epidemic²⁰. In addition to the improved safety performance of cars, this is considered to reflect the fact that the habit of staying at home to prevent the spread of COVID-19 has become established.

On the other hand, the decrease in the number of surgeries for malignant tumors is a nationwide trend, not just in the field of plastic surgery. In 2020, the number of surgeries for gastric cancer decreased by 28% from the previous year²¹. This was attributed to a decline in the number of people undergoing cancer screening, with more than half of people avoiding health screenings early in the COVID-19 epidemic in Japan. The number of cancer screening patients in 2020 and 2021 was -27.4 and -10.3% respectively, compared with that before the COVID-19 epidemic^{22, 23}. It has been reported that there are about 2,100 undetected cancers due to the trend of people avoiding medical examinations in Japan, which is one of the reasons for the decrease in new cancer patients²⁴.

Patients with non-acute diseases are also likely to be affected by requests to restrict surgery due to tight medical resources during the COVID-19 epidemic. As shown in Figure 3, the number of plastic surgeries in non-acute disease patients varies widely from -40 to +120%. This indicates that operations were postponed en masse during the end-epidemic period, or that patients were hospitalized intensively during the end-epidemic period of COVID-19. Non-acute disease groups for which elective surgery is possible are subject to strong surgical suppression during periods when surgical suppression recommendations are issued. Over the long-term, however, the results indicate that performing more surgeries during epidemic troughs does not significantly reduce the total number of surgeries for non-acute diseases.

Jain A et al. predicted that it would take 7 to 16 months to treat all patients scheduled for total arthroplasty and spinal fusion whose surgery was postponed due to the COVID-19 epidemic⁵. Since these surgeries require sterile operating rooms and orthopedic surgeons with special skills, it is considered that it will take this long to operate on all waiting patients. However, typical elective surgeries in the field of plastic surgery, such as resection of benign tumors and covering of chronic ulcers, rarely require extensive or specialized equipment. Therefore, it was considered that elective surgery could be completed early by performing surgery when the epidemic subsided

and there were vacant hospital beds.

Conclusion

Although the COVID-19 epidemic significantly reduced the number of plastic surgeries, the impact waned later in the epidemic. Contrary to expectations, the number of surgeries in the acute disease group, which was not subject to surgical restrictions, decreased significantly. This was attributed to a significant reduction in the number of malignant tumors and trauma patients.

Currently, the 8th wave of COVID-19 presents an unprecedented epidemic, but judging from the trends over the past three years, it is expected that the impact of the epidemic on the decrease in the number of surgeries will gradually decrease.

Conflicts of Interest Statement

All authors (Masaki Fujioka, Kiyoko Fukui, Kentaro Yoshino, and Marie Idemitsu) have not received conflicts of interest and sources of funding, including employment, grants, patent ownership, and other interests.

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