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## Successful Surgical Treatment of Coronavirus Disease 2019 (COVID-19) Vaccination Related Upper Extremity Lymphedema : Case Report

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### Abstract:

Lymphedema is rare adverse effect of COVID-19 vaccination which was reported at several literatures. We present a case of surgically treated secondary lymphedema after the COVID-19 vaccination. The patient presented lymphedema at the upper extremity with no specific history except the COVID-19 vaccination 18 months before the visit. LVA and liposuction for the posterolateral aspect of forearm and upper arm was performed. The volume of the affected arm was reduced to more than 54 percent at the postoperative 8 months. With precise surgical planning, secondary lymphedema occurred after the COVID-19 vaccination could be successfully treated surgically.

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# Successful Surgical Treatment of Coronavirus Disease 2019

## (COVID-19) Vaccination Related Upper Extremity

### Lymphedema : Case Report

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#### Abstract

Lymphedema is rare adverse effect of COVID-19 vaccination which was reported at several literatures. We present a case of surgically treated secondary lymphedema after the COVID-19 vaccination. The patient presented lymphedema at the upper extremity with no specific history except the COVID-19 vaccination 18 months before the visit. LVA and liposuction for the posterolateral aspect of forearm and upper arm was performed. The volume of the affected arm

was reduced to more than 54 percent at the postoperative 8 months. With precise surgical planning, secondary lymphedema occurred after the COVID-19 vaccination could be successfully treated surgically.

**Keywords:** COVID-19 Vaccines, Adverse effect, Lymphedema, Secondary lymphedema, Surgical Procedures

## **Introduction**

After the outbreak of Coronavirus Disease 2019 (COVID-19), millions of doses of COVID-19 vaccine were administered world widely. Among them, more than 2500 million doses of BNT162b2 (Pfizer Inc., New York, NY, USA and BioNTech, Mainz, Germany) vaccine was administered until 2021.(1) Lymphedema is rare adverse effect of COVID-19 vaccination which was reported at several literatures. Both lower extremity and upper extremity lymphedema was reported.(2-4) Furthermore, report of outbreak of lymphedema after COVID-19 vaccination in breast cancer patient and frequent lower leg cellulitis after vaccination is also reported.(5, 6) In summary, though its incidence is relatively rare, lymphedema after COVID-19 vaccine certainly exists, and treatment option is not reported well.

Lymphedema is condition caused by mechanical or intrinsic disruption of lymphatic flow. Surgical treatment option for the lymphedema is divided into two categories: ablative and physiologic surgery. Ablative surgery can be represented by Charles procedure and liposuction which removes the hypertrophied fat tissue and fibrosis induced by chronic condition of lymphedema. Physiologic surgery includes lymphatico-venous anastomosis (LVA), lymph node-to-vein anastomosis (LNVA) and vascularized lymph node transfer (VLNT). Physiologic surgery is nowadays possessing its main role in surgical treatment of lymphedema. However, in

advanced stage of lymphedema, excess adipose tissue is hard to be removed with physiologic surgery.(7) In those cases, liposuction is reported to be effective in reducing the volume and improving the quality of life.(8)

In this case report, we present a case of secondary lymphedema occurred after the vaccination of Pfizer (BNT162b2) vaccine including the booster and treated surgically combining the physiologic surgery (LVA) and ablative surgery (Liposuction) successfully.

### **Informed consent**

Informed consent was obtained from the patient for the publication of this case report and any accompanying images. The patient was thoroughly informed about the purpose of the report, the nature of the information to be disclosed, and the potential implications of its publication. The patient understood their participation was voluntary and had the right to withdraw consent at any time without any impact on their medical care. The patient provided written consent, agreeing to share their medical case for educational and research purposes.

### **Clinical details**

An 80-year-old female patient presented to the plastic surgery clinic with right upper extremity edema with pitting and firm change on lateral and posterior aspect of upper arm and forearm. (Fig 1A, 1B) There was no history of trauma at the affected side of the arm and trunk nor the operative history. The patient got vaccination for COVID-19 18 months before the visit. It was the secondary vaccination with BNT162b2 (Pfizer-BioNTech), and the edema occurred at the same side of arm where the vaccine was administrated. The edema started three days after vaccination. The patient had multiple events of cellulitis and received intravenous antibiotics. Then the patient was referred to the rehabilitation medicine

department and received compression treatment using compression bandage which was prescribed from rehabilitation medicine department for 1 years. However, response to the treatment was refractory. Then the patient was referred to the plastic surgery department. The patient got admission from the Ministry of the Health and Welfare of Korea about the relationship between the edema and the vaccination as an adverse effect.

To exclude the possible cause of the lymphedema, chest computed tomography (CT) was taken, however, there was no evidence of any malignancy. As a preoperative work up, upper extremity lymphoscintigraphy and magnetic resonance lymphangiography (MRL) was taken. In lymphoscintigraphy, increased dermal backflow at distal forearm of the affected side and absent uptake at the ipsilateral axillary lymph node was found which was correlated with lymphedema sign. (Fig 2) At MRL, multiple dilated lymphatic vessels around left wrist to forearm was found with diffuse dermal backflow at the dorsum of hand and mid forearm. The circumferential size of the patient and bioelectric impedance test is described in Table 1.

### **Surgical treatment**

For the patient, as there was no operative history on the axillary area, LVA at the wrist level and liposuction for the posterolateral aspect of forearm and upper arm was planned. Before the operation, lymphatic vessel was traced using ultrasonography and indocyanine green (ICG) lymphangiography. Then the incision site was determined according to the preoperative tracing. At two incisions on the wrist, two ectatic lymphatic vessel with thin wall were found, of which size was 0.4 and 0.6 mm respectively. Successful LVA was performed using side to end manner. After the anastomosis, indocyanine green (ICG) washout to the anastomosed vein could be seen. (Fig 3) Then, the ultrasound assisted liposuction was performed using Tumescent technique. Total 850 cc of the fibrotic tissue and fat. After operation, immediate compression with double layered compression bandage (Deflate, HS Healing Solution limited, Tsimshatsui, Hong Kong).

## **Outcome**

The circumference of the affected arm was reduced 8 cm at the upper arm and 8.3 cm at the distal forearm at 8 months of follow up. The estimated arm volume was reduced from 2285.98cm<sup>3</sup> to 1242.24cm<sup>3</sup>. (Reduction rate 54.34 percent, Fig 4A, B) The bioelectric impedance analysis of extracellular fluid of affected limb was reduced from 5.23 to 2.98. Fig 5 shows the lymphoscintigraphy findings at 8 months of follow up. The patient maintained the compression therapy using compression bandage until the last follow up.

## **Discussion**

The cause-and-effect relationship of upper extremity lymphedema and COVID-19 vaccination should be carefully judged. There are limited reports of secondary lymphedema occurred after COVID-19 vaccination. Interestingly there are more reports of lower extremity lymphedema while there is only one report the upper extremity lymphedema. The case report of upper extremity lymphedema reported the development of edema after the Pfizer-BioNTech mRNA vaccine booster which is same as our case.

Vaccine induced lymphadenopathy caused by antigen transmit to the lymph node are suggested as a pathophysiology of lymphedema after the vaccination.(9) According to the literature, lymphadenopathy caused by vaccination can aggravate the lymphatic drainage especially in vulnerable patients, which can lead to development of lymphedema. Furthermore, some literatures have suggested the COVID-19 mRNA vaccination has been linked with inflammatory response to hyaluronan.(10, 11) Lymphatics are the primary pathway for hyaluronan drainage of which dysfunction may result in hyaluronan accumulation.(12) These

can be the possible mechanism of mRNA COVID-19 vaccine induced lymphedema. Several studies reported lymphedema and cellulitic events following COVID-19 vaccinations. (3, 5) However, there is no report of successful treatment of secondary lymphedema after COVID-vaccination neither nonsurgically nor surgically. In this case, considering the previous failure of physical treatment including compression, surgical treatment was attempted. With meticulous preoperative work up and planning, successful treatment could be achieved.

In the follow up lymphoscintigraphy, overall dermal backflow was increased compared to the preoperative study. There are some debates about the dermal backflow pattern in lymphoscintigraphy. Dermal backflow was deemed as a sign of lymphedema, however, its absence is considered backwardly, as a sign of most advanced stage of lymphedema.(13) Furthermore, there is report of the surgical outcome of lymphedema is better in cases with dermal backflow at lymphoscintigraphy compared with the cases without dermal back flow. (14) There is report of treatment decisions should be based on the clinical symptom not only with the severity of dermal backflow.(15) Therefore, we interpreted that increased dermal backflow after the operation can be the favorable sign of clinical improvement.

It is interesting finding that edema at the affected side hand dorsum and finger was reduced markedly with prominent wrinkle even if the operation including liposuction was not made at the hand dorsum. This finding implicates the surgical management for the lymphedema can aid not only the operated region, but also improves the overall lymphatic washout at whole affected limb. However, as the lymphedema is deteriorating condition surgical options should be provided to the patients with decongestive treatment as well.

## **Conclusion**

Lymphedema is rare side effect of COVID-19 vaccination with limited treatment options. Along with precise surgical planning, secondary lymphedema occurred after the COVID-19 vaccination could be successfully treated surgically.

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Figure 1. Preoperative findings

Figure 2. Preoperative lymphoscintigraphy

Figure 3. A, C: The picture after the lymphaticovenous anastomosis. B, D: Indocyanine green lymphography of each anastomosis site respectively.

Figure 4. 8 months postoperative findings

Figure 5. Postoperative lymphoscintigraphy (8 months postop.)

Table 1. Circumference and bioimpedance analysis data of the patient (cm, +/- Cubital fossa)

<b>Table 1. Circumference data of the patient (cm, +/- Cubital fossa)</b>									
	BMI	BIA*	+15	+10	+5	-5	-10	-15	Volume (cm <sup>3</sup> )
PreOP	27.0								
Affected		5.23	33.5	34.0	35.0	32.0	30.3	28.3	2285.98
Normal		1.99	27.0	23.5	20.0	20.5	17.5	15.0	1082.01
Postop 3m	25.6								
Affected		3.09	28.0	27.0	26.0	23.5	22.0	19.0	1335.19
Normal		2.16	26.0	23.0	21.0	21.0	17.5	15.5	1050.36
Postop 8m	25.6								
Affected		2.98	25.5	24.0	22.5	22.5	22.0	20.0	1242.24
Normal		1.94	26.0	23.0	21.0	21.5	17.5	15.5	1050.36

\*. Bioelectric impedance analysis - extracellular water/total body water





















