Abstract. – OBJECTIVE: Since the outbreak of COVID-19 pandemic, the international scientific community aimed at developing a vaccine to protect against the infection and prevent serious forms of the disease. To date, various adverse events of COVID-19 vaccines have been reported, mostly mild to moderate.

MATERIALS AND METHODS: In this short communication, we reviewed available literature and described the most frequent otolaryngology adverse events reported after COVID-19 vaccination.

RESULTS: The most frequent adverse events following COVID-19 vaccine described in the literature are represented by audiovestibular symptoms, such as tinnitus, sudden sensorineural hearing loss, vertigo, and dizziness. Other side effects include facial nerve palsy, epistaxis, and oral manifestations (lichen planus, bleeding, ulcers, and vesicles).

CONCLUSIONS: COVID-19 vaccine is of utmost importance in limiting the spread of SARS-CoV-2. Otolaryngology-related side effects have been described, but none was severe or life threatening. The mechanisms underlying these effects are still mostly unknown.

Key Words: COVID-19, Vaccines, Adverse events, Otolaryngology.

Introduction

The progressive spread of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has caused dramatic effects on national health care systems. Since then, the scientific community aimed at developing a vaccine to protect against the infection and prevent serious forms of the disease. The first COVID-19 vaccine approved by European Medicines Agency (EMA) in December 2020 was developed by BioNTech Manufacturing GmbH (Mainz, Germany) and Pfizer Inc (New York, NY, USA). Afterwards, several vaccines have been developed: messenger RNA (mRNA) vaccines (mRNA-1273, Moderna) or vaccines made using human and primate adenovirus vectors, like Ad26.COV2.S (Janssen - Johnson & Johnson) and ChAdOx1 nCov-19 (Oxford/AstraZeneca).

To date, various side effects of COVID-19 vaccines have been reported, mostly mild to moderate. This is the first article that reviews and comments the most frequent otolaryngology adverse events reported after COVID-19 vaccination.
Di Mauro et al.\textsuperscript{9} reported 30 patients with acute vertigo and 3 patients with dizziness occurring within 48 hours after COVID-19 vaccination. Among them, 9 cases had benign paroxysmal positional vertigo and in 7 cases there was no clinical evidence of vestibular or central impairment.

Wichova et al.\textsuperscript{10} reported 25 patients with SSHL, 15 with tinnitus, 8 with dizziness and 5 with vertigo. Another study\textsuperscript{11} performed to investigate the side effects of the Pfizer-BioNTech vaccine among healthcare personnel shown vertigo-like symptoms in 20 cases and tinnitus in 16 cases. Table I details the audiovestibular disorders after COVID-19 vaccination reported in literature.

The pathophysiological mechanisms of audiovestibular alterations after COVID-19 vaccination are unclear. Generally, reported cases present a history of atopy and autoimmune disorders; pathogenesis could therefore involve a hypersensitivity reaction, an abnormal autoimmune response and a vasculitis or vascular ischemia directing to the cochlea or vestibular system\textsuperscript{12,13}.

### Facial Nerve Palsy
Unilateral facial nerve palsy has been reported after COVID-19 vaccine. During the trial for Pfizer-BioNTech, 4 cases of facial palsy in a population of 38,000 persons (0.0105\%) were reported by the FDA\textsuperscript{14}. In Moderna vaccine phase 3 trials, 3 cases of Bell's palsy were reported in the arm of vaccine involving 30,420 participants (0.0098\%). During the clinical trial for Oxford-AstraZeneca, 3 cases were reported among 12,021 participants (0.025\%).

The pathogenesis of these events is unclear; it could be caused by the reactivation of latent dormant virus, as shown for the influenza and meningococcal vaccines\textsuperscript{19,20}.

Table II shows the results of phase 3 trials regarding facial nerve palsy after COVID-19 vaccination.

### Other Adverse Events
Table III lists other otolaryngology adverse events reported in the literature after COVID-19 vaccine. They include epistaxis and oral cavity alterations.

A large population cohort study\textsuperscript{21} investigated bleeding episodes after COVID-19 vaccination and reported an incidence of nose bleeding of 0.3\% after the first dose and 0.5\% after the second dose of mRNA vaccines (Pfizer-BioNTech or Moderna). The incidence of epistaxis after adenovectored vaccines (Oxford-AstraZeneca) was

![Table I. Audiological and vestibular adverse events reported in the literature after COVID-19 vaccination. SSHL: Sudden Sensorineural Hearing Loss.](image-url)
Otolaryngology adverse events following COVID-19 vaccines

Table III. Other otolaryngology adverse events after COVID-19 vaccination.

<table>
<thead>
<tr>
<th>Author</th>
<th>Vaccine</th>
<th>Epistaxis</th>
</tr>
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<tbody>
<tr>
<td>Trogstad et al</td>
<td>Pfizer-BioNTech</td>
<td>9 (0.3%) first dose</td>
</tr>
<tr>
<td>Moderna</td>
<td>15 (0.5%) second dose</td>
<td></td>
</tr>
<tr>
<td>Oxford-AstraZeneca</td>
<td>106 (2.1%) first dose</td>
<td></td>
</tr>
<tr>
<td>Sharda et al</td>
<td>Pfizer-BioNTech</td>
<td>Lichen planus (1 patient)</td>
</tr>
<tr>
<td>Riad et al</td>
<td>Pfizer-BioNTech</td>
<td>Burning or bleeding gingiva 17/522 (3.3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blisters 11/522 (2.1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulcers 10/522 (1.9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vesicles 8/522 (1.5%)</td>
</tr>
</tbody>
</table>

2.1%; the difference between these two vaccines was statistically significant21. The study hypothesized that both mRNA and adeno-vectored vaccines may cause an immune-mediated platelet destruction and thrombocytopenia22.

Some case reports23 of cutaneous lichen planus have been reported after vaccination; among them, only one case regarded the oral cavity in a 35-year-old female without history of lichen planus or other dermatological pathologies after Pfizer-BioNTech vaccine24.

Other side effects in the oral cavity after Pfizer-BioNTech vaccines have been reported by Riad et al25; they included burning or bleeding gingiva (3.3%), blisters (2.1%), ulcers (1.9%) and vesicles (1.5%). In small number of cases angular cheilitis, halitosis and xerostomia have been reported. Generally, these events occurred 1-3 days after the vaccination.

Conclusions

COVID-19 vaccine is of utmost importance in limiting the spread of SARS-CoV-2. As of today, more than 10 billion doses have been administrated worldwide and only a limited number of side effects have been reported. In the otolaryngology field, adverse events included audiovestibular alterations, facial palsy, and epistaxis. However, in no case they were severe or life threatening. The mechanisms underlying these effects are still mostly unknown.

Conflict of Interest
All authors declare no conflicts of interest.

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