

Medical Device-Related Pressure Injury to the Ear from a Mask

Jeffrey M. Levine, MD, AGSF, CMD, CWS-P; Elizabeth A. Ayello, PhD, MSN, BSN, ETN, RN, CWON, MAPWCA, FAAN; Balwant Persaud, LPN; and Ruth Spinner, MD, CMD

ABSTRACT

Mask wearing is now ubiquitous because of the COVID-19 pandemic and has given rise to medical device-related pressure injuries in persons at risk of skin breakdown. The ear has unique anatomy that is particularly susceptible to injury from pressure. In this time of mandatory personal protective equipment requirements in healthcare facilities, protection and assessment of skin in the vulnerable postauricular area are needed. This article presents a case report of a pressure injury on the ear, reviews the anatomy of the ear, and provides strategies for assessment and treatment of pressure injuries in this often overlooked anatomic region.

KEYWORDS: COVID-19, ear, infection control, mask, MDRPI, medical device-related pressure injury, long-term care, pressure injury, wound care

ADV SKIN WOUND CARE 2021;34:380–3.

DOI: 10.1097/01.ASW.0000752712.31139.c0

CASE REPORT

An 85-year-old wheelchair-bound long-term care (LTC) resident developed a wound in the postauricular area of his left ear from a mask as shown in Figure 1. His medical history included moderate dementia, osteoarthritis, hyperlipidemia, benign prostatic hypertrophy, coronary artery disease, and chronic kidney disease stage 3. The mask was a standard disposable surgical mask made of nonwoven polypropylene secured with elastic loops over the ears. The resident enjoyed spending time outside of his room, where the mask was worn continuously throughout the day except for meals.

The patient was treated by discontinuation of the surgical mask, clipping of hair around the wound, and protective gauze. His surgical mask was replaced with a mask that did not wrap around the ears. Although there was no evidence of local cellulitis, a topical antibiotic was administered for the first few days as a cautionary measure and to remove potential colonizers. In 2 weeks, the area was completely re-epithelialized.

This lesion was considered a facility-acquired pressure injury and discussed in an interdisciplinary care plan meeting with a nutritionist and recreational therapist present. Root-cause analysis showed that because this resident was of large body habitus, standard surgical masks were too tight and required substitution. Mask wearing procedures including related adverse events were a component of facility-wide education related to the COVID-19 pandemic.

CLINICAL CONCEPTS

Anatomy of the Ear

The ear is made up of three parts: the outer, middle, and inner ear (Figure 1). The outer or external ear includes the auricle or pinna, which is composed of cartilage covered by skin; the auditory canal; and the outer layer of the eardrum, also called the tympanic membrane. The

Jeffrey M. Levine, MD, AGSF, CMD, CWS-P, is Associate Clinical Professor of Geriatric Medicine and Palliative Care, Icahn School of Medicine at Mount Sinai, New York, NY; and Consultant, Advantage Surgical and Wound Care, El Segundo, CA. Elizabeth A. Ayello, PhD, MSN, BSN, ETN, RN, CWON, MAPWCA, FAAN, is co-Editor-in-Chief, *Advances in Skin and Wound Care*, Philadelphia, PA; Faculty Emeritus, Excelsior College School of Nursing, Albany, NY; and President, Ayello Harris & Associates, Inc, Copake, NY. Balwant Persaud, LPN, is Licensed Practical Nurse, Department of Nursing, New Jewish Home, New York, NY. Ruth Spinner, MD, CMD, is Senior Medical Director, The New Jewish Home; Assistant Clinical Professor of Geriatric Medicine and Palliative Care, Icahn School of Medicine at Mount Sinai, New York, NY; and Wound Consultant, Advantage Surgical & Wound Care. **Acknowledgments:** Dr Ayello was a member of the small working group for the chapter on medical device-related pressure injuries for the 2019 Clinical Practice Guideline for which she received no compensation. Dr Ayello has also served as an advisor to the CMS for long-term care on the Resident Assessment Instrument manual for Section M, pressure injuries. The authors have disclosed no financial relationships related to this article. Submitted October 30, 2020; accepted in revised form February 6, 2020.



Figure 1. POSTAURICULAR PRESSURE INJURY FROM MASK



outer ear not only functions to direct sound waves to the middle and inner ear, but also provides a location for body modifications such as piercing, a platform for eyeglasses and hearing assistance devices, and an anchor for facial masks used to limit spread of infection.¹

The surface and cross-sectional anatomy of the external ear are pictured in Figures 2 and 3. Components include the helix, antihelix, concha, tragus, antitragus, ear canal, and lobule. The space behind the ear is known as the postauricular area.² The external ear is attached to the skull with ligaments and muscles that are both intrinsic and extrinsic. The extrinsic muscles hold the auricles in place and are responsible for reinforcement, positioning, and angle of the auricle (Figure 4).³ These include the anterior auricular, superior auricular, and posterior auricular muscles along with tendons composed of fibrous connective tissue. Ear muscles have lost their function through evolution and thus are vestigial structures, much like the appendix or wisdom teeth.^{4,5}

Figure 2. ANATOMY OF THE EXTERNAL EAR

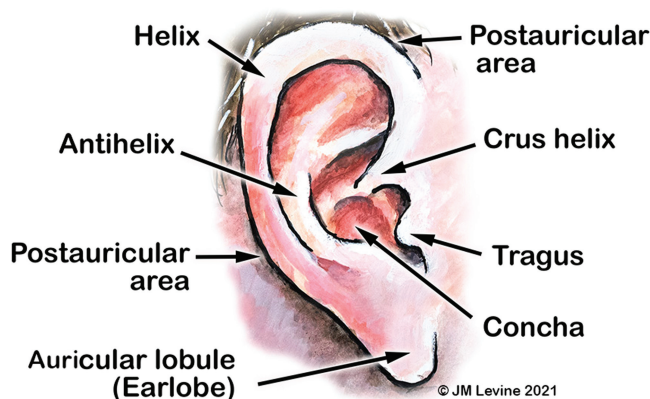
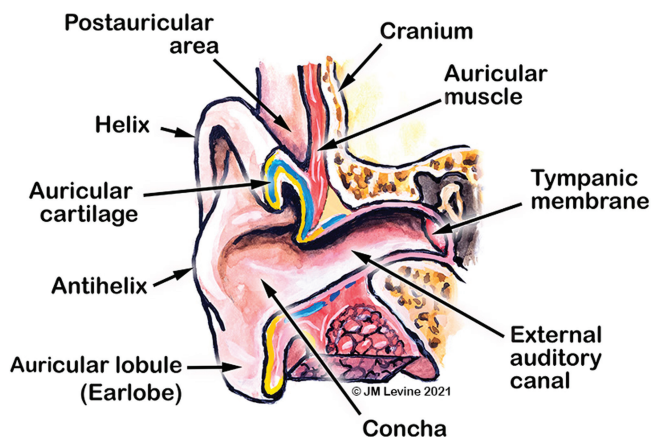


Figure 3. CROSS-SECTIONAL ANATOMY OF THE EAR

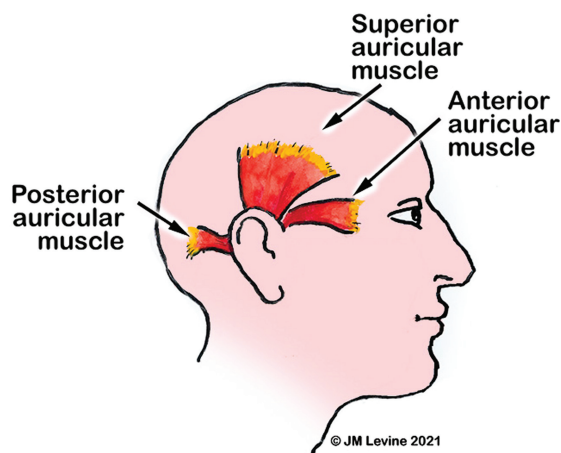


There are three types of cartilage: hyaline, fibrous, and elastic. Cartilage is avascular and relies on diffusion to obtain nutrients and heals slowly when damaged.⁶ Auricular cartilage is the elastic type that helps maintain the shape of the ear while allowing flexibility. As well as a convenient anchor for masks and eyeglasses, the auricle is subject to environmental influences and trauma and is often affected by UV light, leading to pre-neoplastic and neoplastic skin lesions.⁷ Diagnosis of injuries and dermatologic diseases in the postauricular area may be missed or delayed because it is hidden behind the ear and/or covered with hair. Medical device-related pressure injuries (MDRPis) have been reported from oxygen tubing behind the ear.⁸⁻¹⁰

Mask Wearing in Healthcare Facilities

The CMS and the CDC have issued recommendations to state and local governments for hospitals and post-acute

Figure 4. MUSCLES OF THE EAR



care/LTC facilities to help mitigate the spread of COVID-19,^{11,12} which include hand hygiene, social distancing and appropriate personal protective equipment for healthcare personnel when interacting with patients and residents, among other measures. The CDC recommends separate staffing teams for residents who are COVID-19-positive regardless of symptoms.¹² According to the Nursing Home Division of Public Health Services, a cloth face covering is likely adequate where there are no confirmed or suspected COVID-19 infections.¹³ The CDC recommends universal source control measures for all patients and residents of healthcare facilities, including nursing home residents.¹² Patients and residents should wear a surgical or cloth facemask when outside of their rooms and when staff enter their rooms. Various state departments of health offer additional recommendations regarding resident usage of masks for post-acute care/LTC facilities, some of them taking into consideration mask shortages.

For maximum effectiveness in preventing the spread of infection, face masks should fit snugly but comfortably against the side of the face.¹⁴ Many surgical masks have elastic components that wrap around the ear, resulting in pressure to this vulnerable area. If the mask is too tight or remains in place too long, pressure-related damage of the skin can occur, causing an MDRPI that should be staged according to the NPIAP staging system.^{9,15} For this case patient, the etiology of the wound was the ear loops on the mask, and the wound should be documented as an MDRPI.

Staging and Documenting MDRPI

The skin of the postauricular area is anatomically unique in that it overlies muscle, tendon, and bone medially and cartilage laterally (Figure 3).¹⁶ These are important considerations when evaluating MDRPI from either masks or oxygen tubing. Average thickness of the combined dermis and epidermis of the ear is 0.8 mm when measured by ultrasound.¹⁷ Cadaver studies using punch biopsies have demonstrated that postauricular skin is thinner than other areas of the ear and is the thinnest skin of the face.¹⁸ Aging in combination with photoaging from chronic sun exposure will increase its vulnerability to pressure injury and other local trauma.¹⁹

Pressure injuries are staged based upon the visible or directly palpable tissue in the ulcer bed.^{15,20} In the US, Medicare-certified skilled nursing facilities must follow the guidance as put forth by CMS in the Resident Assessment Instrument manual for coding of pressure injuries. Page M-19 of the current manual states the following: "Cartilage serves the same anatomical function as bone. Therefore, pressure ulcers that have exposed cartilage should be classified as a Stage 4."²¹ In this clinical exemplar, cartilage is directly visible in the base of the wound,

therefore rendering this pressure injury classification a stage 4. Wound documentation should include stage, size, location, and presence of drainage. The wound location for this resident should be documented as the upper or superior postauricular area of the left ear, or more simply as the upper area behind the left ear.

Preventing Mask-Related Pressure Injury

By identifying at-risk patients and following best practices for pressure injury prevention, it is usually possible to stop pressure injuries before they develop.¹⁵ Preventing skin breakdown from masks is important for all, including family members who require education and awareness of potential skin breakdown.²² Persons with dementia, aphasia, or sensory loss may not be able to complain of the pain that often heralds or accompanies skin breakdown. Other physiologic factors such as longstanding diabetes mellitus and malnutrition can compound risk of skin breakdown.¹⁵ Persons with limited motion of their upper extremities may not be able to lift their arms or have the requisite finger dexterity to loosen a tight mask.

The MDRPI prevention recommendations adapted for face masks are as follows:¹⁵

- Consider all patients with masks to be at risk of breakdown behind the ear;
- Using the finger to test tension, make sure the mask is not too tight around the ear;
- Inspect the skin surrounding and under the mask (including the mask ear loops) at least twice per day, or more if the patient is at high risk of skin breakdown;
- Apply the mask only when necessary, and remove mask as soon as medically possible;
- For residents of Medicare-certified skilled nursing facilities, application of face mask in conjunction with a plan for avoidance of skin breakdown should be part of the care plan;
- Consider using an "ear saver" mask strap to avoid pressure and friction to the postauricular area (see Figure 5).

There is some evidence that dressings applied beneath medical devices can play a role in preventing MDRPI.²³ However, the use of preventive dressings does not alleviate provider responsibility to identify high-risk persons, perform frequent skin inspections, and check if the mask is too tight.

Treating Mask-Related Pressure Injury

Begin by removing the offending device. If the patient continues to require a mask, provide a mask or "ear saver" mask strap that secures around the head or back of the neck rather than the ear, although again, this does not remove the need for continued skin assessment to areas subjected to pressure and friction.



Figure 5. “EAR SAVER” MASK STRAP



Infection should be considered and ruled out. Local cellulitis is characterized by warmth, redness, pain, and swelling. Presence of purulent discharge might indicate deeper infection and/or abscess. If infection is present, treatment should be initiated with topical and/or systemic antibiotics, depending on culture and severity. Removing hair in the area may be helpful, because it eliminates foreign body intrusion into the wound base, as well as a source of contamination, consistent with the principles of wound bed preparation.²⁴⁻²⁶

It is important to note that a healed wound may not have the same physical strength as normal tissue and may be prone to recurrence, also known as recidivism.²⁷

CONCLUSIONS

The ear has unique anatomy that increases vulnerability to injury from pressure, specifically from medical devices such as masks or oxygen tubing. These pressure injuries are staged by the type of tissue that is seen or palpable and not by depth. In practice, it may be challenging for clinicians to agree on what tissue is being seen or felt; a pressure injury may look “shallow,” but can involve deeper layers of the skin. Given the unique anatomy of the ear, a pressure injury may still reach cartilage, bone, tendon, or muscle, classifying it as stage 4.^{15,22}

Considering the increased use of personal protective equipment during the COVID-19 pandemic, and mandatory requirements in healthcare facilities, protection and assessment of patients’ and residents’ skin in the vulnerable postauricular area are needed. Skin protection

beneath the straps of the mask and evaluation of the tension of the mask straps may also be a part of prevention strategies. ●

REFERENCES

- Smith RM, Byrne PJ. Reconstruction of the ear. *Facial Plast Surg Clin North Am* 2019;27(1):95-104.
- Kim JK, Bae IH, Kim MS, Choi H, Na CH, Shin BS. A study of skin disease of the external ear in older adults according to anatomical location. *Ann Geriatr Med Res* 2018;22(2):88-93.
- Liugan M, Zhang M, Cakmak YO. Neuroprosthetics for auricular muscles: neural networks and clinical aspects. *Front Neurol* 2017;8:752.
- Szymanski A, Geiger Z. *Anatomy, Head and Neck, Ear*. Treasure Island, FL: StatPearls Publishing; 2020.
- Encyclopedia Britannica. 7 Vestigial Features of the Human Body. www.britannica.com/list/7-vestigial-features-of-the-human-body. Last accessed April 6, 2021.
- Janis JE, Harrison B. Wound healing: part 1: basic science. *Plast Reconstr Surg* 2016;138(3 Suppl):9S-17S.
- Ozturkcan S, Ozturkcan S. Dermatologic diseases of the external ear. *Clin Dermatol* 2014;32(1):141-52.
- Black JM, Cuddigan JE, Walko MA, Didier LA, Lander MJ, Kelpie MR. Medical device related pressure ulcers in hospitalized patients. *Int Wound J* 2010;7(5):358-65.
- Delmore BA, Ayello EA. Pressure injuries caused by medical devices and other objects: a clinical update. *Am J Nurs* 2017;117(12):36-45.
- Barakat-Johnson M, Barnett C, Wand T, White K. Medical device-related pressure injuries: an exploratory descriptive study in an acute tertiary hospital in Australia. *J Tissue Viability* 2017;26(4):246-53.
- Centers for Medicare & Medicaid Services. COVID-19 Response News Alert: CMS Issues Key Protective Mask Guidance for Healthcare Workers. March 2020. www.cms.gov/newsroom/press-releases/covid-19-response-news-alert-cms-issues-key-protective-mask-guidance-healthcare-workers. Last accessed April 6, 2021.
- Centers for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Healthcare Personnel during the Coronavirus Disease 2019 (COVID-19) Pandemic. February 2021. www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html. Last accessed April 6, 2021.
- New Hampshire Department of Health and Human Services. COVID-19 Universal Mask Recommendation for Long-term Care and Assisted Living Facilities. May 2020. www.dhhs.nh.gov/dphs/cdcs/covid19/ltcf-mask-recommendation.pdf. Last accessed April 6, 2021.
- Centers for Disease Control and Prevention. Use of masks to help slow the spread of COVID-19. February 2021. www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html. Last accessed April 6, 2021.
- European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. Haesler E, ed. EPUAP/NPIAP/PPPIA; 2019.
- Sand M, Sand D, Brors D, Altmeyer P, Mann B, Bechara FG. Cutaneous lesions of the external ear. *Head Face Med* 2008;4:2.
- Danter J, Siegert R, Weerda H. Ultrasound measurement of skin and cartilage thickness in healthy and reconstructed ears with a 20-MHz ultrasound device [in German]. *Laryngorhinootologie* 1996;75(2):91-4.
- Chopra K, Calva D, Sosin M, et al. A comprehensive examination of topographic thickness of skin in the human. *Face Aesthetic Surg J* 2015;35(8):1007-13.
- Levine JM. Clinical Aspects of aging skin: considerations for the wound care practitioner. *Adv Skin Wound Care* 2020;33:12-9.
- National Pressure Injury Advisory Panel. NPIAP Pressure Injury Stages. <https://npiap.com/page/PressureInjuryStages>. Last accessed April 6, 2021.
- Centers for Disease Control and Prevention. Long-term Care Facility Resident Assessment Instrument 3.0 User's Manual. Version 1.17.1. October 2019. https://downloads.cms.gov/files/mds-3.0-rai-manual-v1.17.1_october_2019. Last accessed April 6, 2021.
- Turjanica MA, Clark L, Martini C, Miller P, Turner BL, Jones S. Incidence, correlates, and interventions used for pressure ulcers of the ear. *Medsurg Nurs* 2011;20(5):241-6.
- Black J, Alves P, Brindle CT, et al. Use of wound dressings to enhance prevention of pressure ulcers caused by medical devices. *Int Wound J* 2015;12(3):322-7.
- Schultz GS, Sibbald RG, Falanga V, et al. Wound bed preparation: a systematic approach to wound management. *Wound Rep Regen* 2003;11 Suppl 1:S1-28.
- Harries RL, Bosanquet DC, Harding KG. Wound bed preparation: TIME for an update. *Int Wound J* 2016;13 Suppl 3:8-14.
- Sibbald RG, Elliott JA, Persaud-Jaimangal R, et al. Wound bed preparation 2021. *Adv Skin Wound Care* 2021;34(4):183-95.
- Tew C, Hettrich H, Holden-Mount S, et al. Recurring pressure ulcers: identifying the definitions. A National Pressure Ulcer Advisory Panel white paper. *Wound Repair Regen* 2014;22(3):301-4.