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Case Report
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Clinical and Anatomical Aspects of Cavernous Sinus Thrombosis Associated to Nasal Piercing

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ABSTRACT

Introduction: body piercings are used on a large scale around the world as a form of body art, communication, self-affirmation, and cultural identification, either by young people or adults. Nevertheless, they are not a harmless procedure and severe complications can occur after a body piercing.

Objective: this study aimed to provide an anatomoclinical report of the case of a twenty-six-year-old woman who suffered from an infection caused by a nose piercing that evolved into cavernous sinus thrombosis.

Case report: a 26-year-old female patient, with a nasal wing piercing, was admitted with a persistent febrile condition, headaches, pain, and retrobulbar pressure for three days. Physical examination showed redness and local pain, nasal, upper lip, and infraorbital edema, proptosis with a slight projection of the right eyeball, partial obstruction of the ipsilateral nostril, fetid and purulent exudate with streaks of blood drained spontaneously through the piercing orifice, mild dyspnea, and prostration. Computed tomography and magnetic resonance imaging showed thickening of the cavernous sinus with visualization of hyperdense tissue on CT and hyperintense signal on MRI compatible with cavernous sinus thrombosis on the right side. After the removal of the piercing and clinical treatment, the outcome was favorable.

Conclusion: given the present case and discussion, it is mandatory to call attention to the risks that the placement of piercings can bring to an individual's health. Piercings are potential causes of infections and adverse complications, which can generate irreversible sequelae and even cause death.

Keywords: Body piercing; Cavernous sinus; Thrombosis.

Introduction

Body piercings are used on a large scale around the world as a form of body art, communication, self-affirmation, and cultural identification, either by young people or adults (SCATIGNA *et al*., 2022; GALLÉ *et al*., 2021; BATTAGIN *et al*., 2010). The prevalence of piercings has increased from approximately 10% in 2010 (BATTAGIN *et al*., 2010) to approximately 41% according to current data (SCATIGNA *et al*., 2022). Considering gender and age, piercings are more prevalent in women compared to men at a mean ratio of 3:1 and in the 20–40 age group (SCATIGNA *et al*., 2022; KLUGER *et al*., 2019; KLUGER *et al*., 2022; KLUGER *et al*., 2019; KLUGER *et al*., 2018). The piercing artifact is placed by piercing the skin and attaching rods made of stainless steel, gold, acrylic, and titanium, among other materials (GALLÉ *et al*., 2021). This might be a significant risk for local or systemic infections, as the disruption of the skin's integrity and the insertion of a permanent foreign body creates a gateway for bacteria and other pathogens. In addition, there is the chance of infection due to a lack of asepsis in the environment where the piercing will be placed and the healing difficulty due to the presence of the piercing itself (SCATIGNA *et al*., 2022; GALLÉ *et al*., 2021; NICOLAS *et al*., 2007). Among the complications reported in the literature are sigmoid sinus thrombophlebitis (NICOLAS *et al*., 2007), endocarditis, meningitis (MARIANO *et al*., 2015), brain abscess (HERSKOVITZ *et al*., 2009), cerebellar abscess (MARTINELLO e COONEY, 2003), and infection by various viruses, such as Hepatitis B and C and Herpes Zoster (GALLÉ *et al*., 2021; NICOLAS *et al*., 2007).

Insertion of a piercing in the "death triangle" area, located on the face, increases the risk of major infections (ER *et al*, 2000). The veins that drain this region have a path of communication with the cavernous sinus, which makes the dissemination of superficial skin infections to this sinus very likely, which can lead to venous thrombosis and even meningitis (MESSAHEL & MUSGROVE, 2009). Among the dura mater sinuses, the cavernous sinus is the site most commonly affected by septic thromboses. (KHATRI & WASAY, 2016).

Cavernous sinus thrombosis presents as a severe clinical condition, with headache, fever, periorbital pain and swelling, conjunctival ecchymosis, eyelid edema, and exophthalmos associated with systemic

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signs and symptoms, such as vomiting, convulsions, tachycardia, leukocytosis and anemia (KHATRI & WASAY, 2016; HUNGARY, 1991; SIMON, 1996).

The most common cause of septic cavernous sinus thrombosis (SCST) is a bacterial infection, but there are also cases of infections by viruses, parasites, and fungi. The etiological agent most identified in patients with SCST and infections caused by piercings is the Staphylococcus aureus (EBRIGHT *et al*, 2001; DINUBILE, 1998). Nevertheless, other infectious agents such as Streptococcus spp, Pseudomonas spp, Gram-negatives, anaerobes, Mucoraceae family, Aspergillus, Coccidioidomycosis, Cytomegalovirus, Herpes simplex, hepatitis, HIV, malaria, toxoplasmosis, have been identified (DE KLEER, 2001; CASELLA, 1988; TABACHNICK, 1975; SEKHAR, 1980; SOUTHWICK *et al*, 1963; KOJAN, 2006; SAADATNIA, 2009; SCRINGEOUR, 1991).

Mortality and morbidity from infectious complications such as SCST have been reduced since the advent of antibiotics. An early diagnosis, combined with the use of antibiotics and other medications at the early stages of infection is essential for the management of SCST (EBRIGHT *et al*, 2001; KHATRI & WASAY, 2016; PAVIOVICH *et al*., 2006).

This study aimed to provide an anatomoclinical report of the case of a twenty-six-year-old woman who suffered from an infection caused by a nose piercing that evolved into cavernous sinus thrombosis.

Case Report

A 26-year-old female patient was admitted to the Arthur Ramos Memorial Hospital, using a ring-type piercing on the right wing of her nose, installed approximately 2 years ago, without intercurrences during the procedure. She informs having noticed redness, itching, and pain in the pierced region 5 to 6 days before seeking care. These symptoms were associated with a persistent febrile condition, headaches, pain, and retrobulbar pressure for 3 days, starting on her own a drug treatment with Nimesulide 3 days ago. She observed and recorded the progression of the inflammatory condition with photos from her cell phone until she decided to come to the health unit (Figure 1a).

Physical examination showed redness and local pain, nasal, upper lip, and infraorbital edema, proptosis with a slight projection of the right eyeball, partial obstruction of the ipsilateral nostril, fetid and purulent exudate with streaks of blood (Figures 1b and 1c), drained spontaneously through the piercing orifice, mild dyspnea, and prostration. Laboratory exams showed leukocytosis with a left shift. Computed tomography and magnetic resonance imaging showed thickening of the cavernous sinus with visualization of hyperdense tissue on CT (Figure 2) and hyperintense signal on MRI (Figure 3), especially on the right side, compatible with cavernous sinus thrombosis.

Figure 2. Cranial Computed Tomography image showing thickening of the cavernous sinus with visualization of evident hyperdense tissue on the right compatible with cavernous sinus thrombosis.

The patient started the treatment under general anesthesia, the causal factor (the piercing) was removed (Figure 1c) and the surrounding tissue was debrided, which was subsequently sutured with 6.0 nylon thread. The patient was referred to the Intensive Care Unit (ICU) where she was medicated with Oxacillin 2g 6/6h, in association with Ceftriaxone 1g 12/12h and Metronidazole 500mg 8/8h. For analgesia, Tramal 50mg 24/24h and Dipyrone 1g 6/6h were used. Hydrocortisone 500mg 6/6h, injectable Vitamin C 1g 24/24h, and Etna (Vitamin B12 + Nucleotides) 1 ampoule/day were also used.

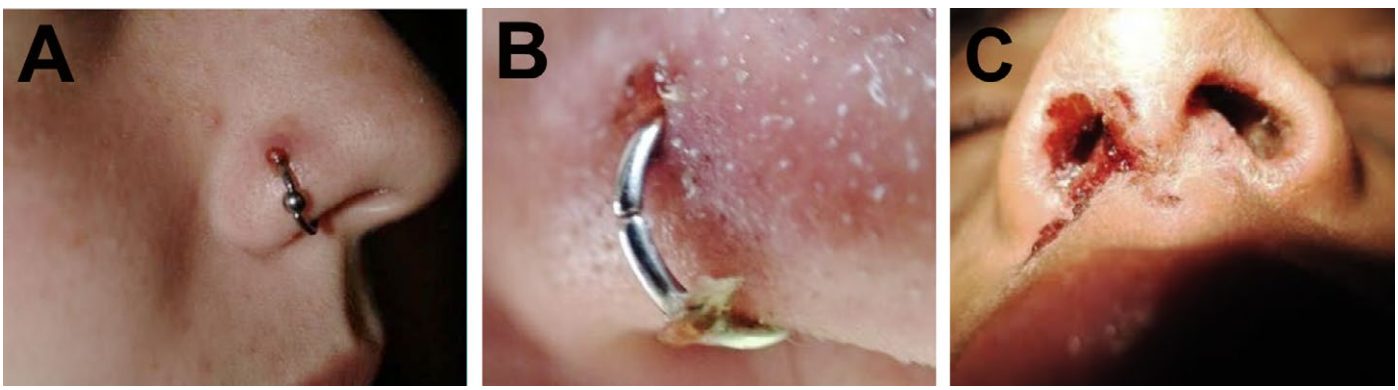

Figure 1. Photos taken with the patient's cell phone, showing the evolution of the inflammation in the piercing region (a, b) and after removal by the health care team (c).

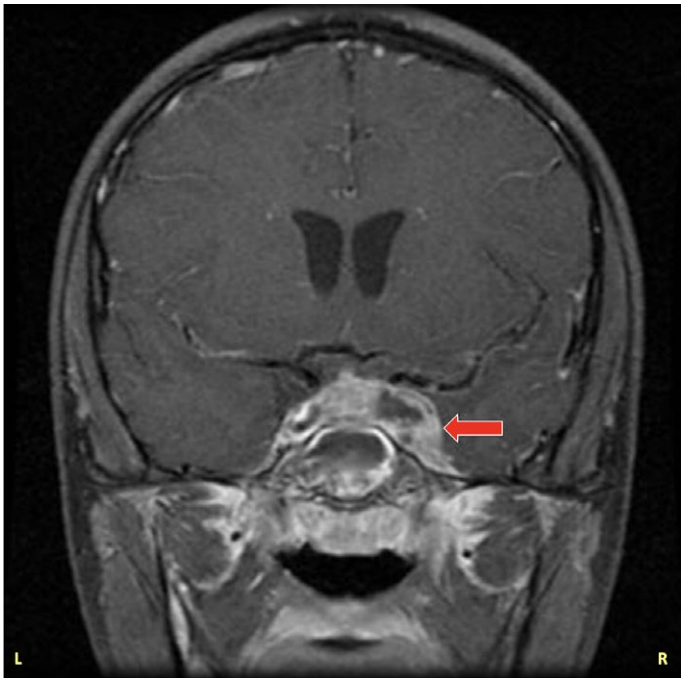

Figure 3. Magnetic resonance imaging of the skull showing thickening of the cavernous sinus with visualization of hyperintense tissue, especially on the right side, compatible with cavernous sinus thrombosis.

After 3 days, the infection showed evident signs of regression, supported by the clinical, imaging, and laboratory evaluation, and the patient was then transferred from the ICU to the infirmary, where, after 7 days, she was discharged, considered cured, without presenting neurological deficits, with preserved visual acuity and muscle movements of facial mime and eyes.

Discussion

Most the cerebral veins drain into the sinuses of the dura mater. The cavernous sinus (CS) is one of the dura mater sinuses with great clinical importance due to its location and anatomical relationship with other neural structures. It is formed by two cavities lateral to the body of the sella turcica on the sphenoid bone. Two venous plexuses (intercavernous sinuses) connect the two parts of the CS anteriorly and posteriorly to the pituitary gland at the sella turcica of the sphenoid bone. The CS extends anteriorly for about 10 to 15 mm from the orbital apex and superior orbital fissure to the foramina of the dura mater that allows entry of cranial nerves III to VI posteriorly (lateral to the clivus of the sphenoid bone). The lateral boundary of the CS is the trigeminal cavity (Cavus of Meckel) in the petrous part of the temporal bone. The medial limit is the sella turcica of the sphenoid bone. Transversely, the CS measures from 5 to 7 mm and, vertically, from 5 to 8 mm (RAZEK, 2009; CASTILLO, 2002; DINUBILE, 1988)

The blood that arrives in the CS comes from the drainage of the superior and inferior ophthalmic veins, central retinal vein, pterygoid plexus, and some smaller encephalic veins (Figure 4). Therefore, facial infections can easily become intracranial when they occur in the "danger triangle of the face or triangle of death", a triangular region, with an apex in the glabella or root of the nose, which extends medially to the orbital area to the upper lip (WALKER and AWTREY, 1938) (Figure 5). The angular veins drain this region, carrying blood and possible pathogens to the superior ophthalmic veins and, these, to the CS. From the CS, the blood drains into the superior and inferior petrosal sinuses, which are continuous with the sigmoid sinus and the internal jugular vein (RAZEK, 2009; NICOLAS *et al*., 2007; DINUBILE, 1988; WALKER and AWTREY, 1938).

The formation of thrombi is directly associated with bacterial infections that move to other sites. The described anatomical connections and the fact that the dura mater sinuses and their emissary's veins do not have valves allow blood flow according to the pressure gradient. This favors the emergence of septic thrombi in the cavernous sinus by driving infectious foci to the CS leading to SCST (KHATRI *et al*., 2016; KOJAN, 2006; EBRIGHT *et al*, 2001; DINUBILE, 1988).

Thus, lesions of vascular, neoplastic, infectious, or infiltrative origin, of the facial, nasal, periocular origin or intrinsic to the CS, can cause internal or external manifestations to the brain, face, eyeball, or cerebral drainage (KHATRI *et al*., 2016; RAZEK *et al*, 2009; EBRIGHT *et al*, 2001; DINUBILE, 1988; PAVIOVICH *et al*, 2006). In the case described, the infection moved through the piercing of the wing of the nose into the CS, culminating in SCST.

The interior of the CS is multiseptate, formed by projections of the dura mater (RAZEK, 2009;

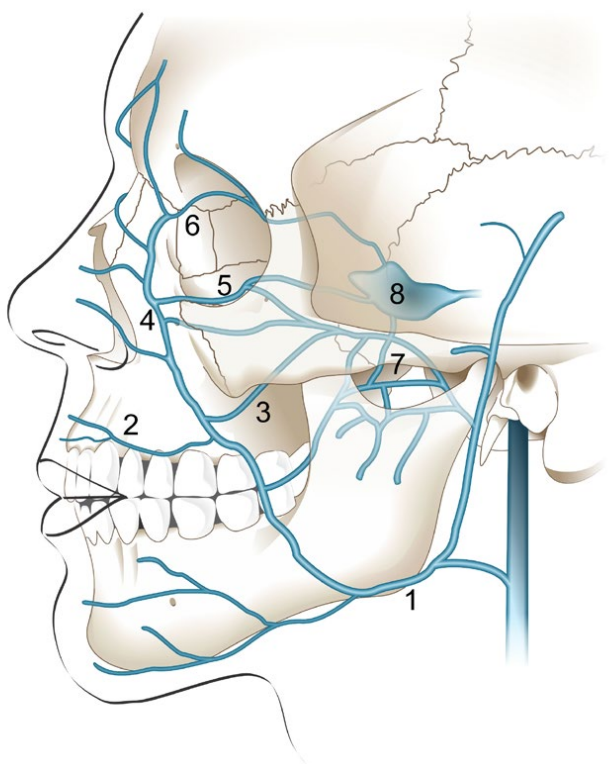

Figure 4. Connections and venous drainage from the face to the cavernous sinus. Facial vein (1), superior labial vein (2), deep facial vein (3), angular vein (4), inferior ophthalmic vein (5), superior ophthalmic vein (6), pterygoid plexus (7) and cavernous sinus (8).

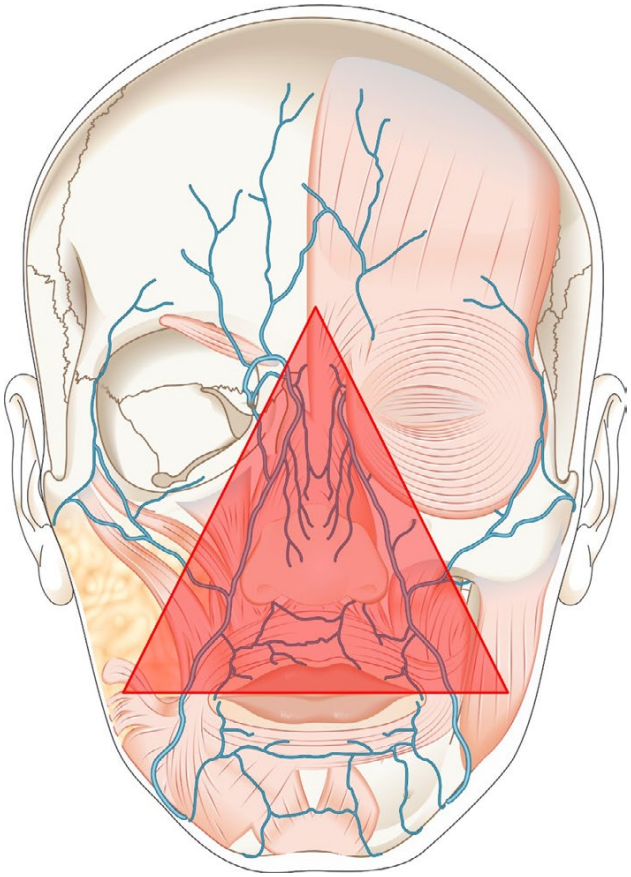

Figure 5. Area called the "dangerous triangle of the face or triangle of death" (in red), showing the existence of facial venous connections that drain into the cavernous sinus.

DINUBILE, 1988; EBRIGHT, 2001). The neurovascular structures that traverse the CS are the internal carotid artery, carotid sympathetic plexus, and abducens nerve (CN VI) (medially), in the region known as the carotid triangle, and cranial nerves III (oculomotor), IV (trochlear), and V (ophthalmic (V1) and maxillary (V2) branches of the trigeminal nerve), located from superior to inferior in the lateral part of the CS, called the oculomotor triangle (Figure 6).

Possible complications of SCST are damage to the cranial nerves that lie in or near the sinus region. Due to its intrasinusal location, the abducens nerve (CN VI) may be the first affected, causing ophthalmoplegia, and the oculomotor (CN III) and trochlear (CN IV) nerves may also be involved in this dysfunction. The pupil may be mydriatic or miotic, resulting from injuries to the parasympathetic part of cranial nerve III or sympathetic injury to the carotid plexus, respectively. A decrease in visual acuity, corneal anesthesia, eye pain, and pain in the upper third of the face due to the involvement of the ophthalmic nerve, a branch of cranial nerve V, can also be evidenced (UDAONDO et. al., 2008; EBRIGHT *et al*, 2001; LANA and BARBOSA, 1998; DINI *et al*, 1999). Remarkably, in the reported case, there were no sequelae as a result of the disorder of the cranial nerves described.

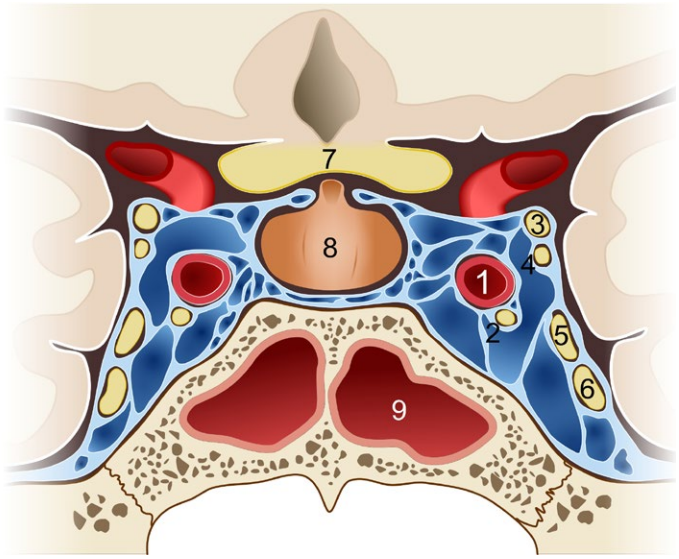

Figura 6. Frontal section of the cavernous sinuses. Carotid artery (1), abducens nerve (2), trochlear nerve (4), oculomotor nerve (3), ophthalmic nerve (5), maxillary nerve (6), optic chiasm (7), pituitary gland (8) and sphenoid sinus (9).

Infection may also spread to the contralateral cavernous sinus, subdural and extradural spaces, arachnoid mater, pia mater, other venous sinuses, cortical veins, and adjacent brain tissues. The infection can become generalized through septic emboli, generating the appearance of abscesses or causing meningitis (DINI *et al*., 1999; SIMON, 1996; YARRINGTON, 1977). The patient in the case described did not present any complications in the meninges, but the study by Mariano *et al*. (2015) reported a case of meningitis associated with endocarditis after the placement of a piercing in the nape of the neck. Infectious spread possibly occurred through the cervical fascia, which provides anatomical planes for the spread of infection. Such fasciae extend from the mediastinal to the suboccipital region and from these to the meninges at the base of the head.

Another relevant relationship in SCST occurs due to CS proximity to the sella turcica of the sphenoid and, consequently, to the pituitary gland. Thus, SCST can be a cause of pituitary hypofunction, generating several systemic complications related to hormones of the adeno- or neurohypophysis. Also, carotid artery lesions may occur, such as occlusion, stenosis, aneurysm, and arteriovenous fistulas due to the intimate relationship between the CS, the internal carotid artery, and the eyeball through the superior orbital fissure (EBRIGHT *et al*, 2001; DINI *et al*, 1999). A clinical sign of carotid artery lesions is proptosis of the eyeball, a condition observed in the reported case. Despite this sign, there were no sequelae in the eyeball or vision after the resolution of the condition by the use of antibiotics. This outcome is very favorable since blindness and retinal or corneal lesions are frequently reported in the literature (UDAONDO et. al., 2008; LANA and BARBOSA, 1998; DINI *et al*, 1999).

As previously mentioned, the piercing can be a gateway to infections and other complications

associated with the cavernous sinus and the dangerous triangle of the face. The literature brings together other regions that may have complications arising from this practice. For example, tongue piercing can result in Ludwig's angina (PERKINS *et al*., 1997), lung abscess, sigmoid sinus thrombophlebitis (NICOLAS *et al*., 2007), and multiple brain (HERKOVITZ *et al*., 2009) and cerebellar abscesses (MARTINELLO and COONEY, 2003). Nasal piercings themselves can cause other related complications and infections, such as endocarditis (BATTAGIN *et al*., 2010) and septic emboli in the kidney and spleen, as well as ear piercings, which can cause toxic shock syndrome and endocarditis (MESSAHEL & MUSGROVE, 2009; HOLBROOK *et al*, 2012). The work by Mariano *et al*. (2015) described 9 cases of cardiac complications of infectious origin, such as infective endocarditis, associated with piercing in different places: tongue, ear, navel, mouth, nose and breast.

Conclusion

Given the present case and discussion, it is mandatory to call attention to the risks that the placement of piercings can bring to an individual's health. Piercings are potential causes of infections and adverse complications, which can generate irreversible sequelae and even cause death.

References

BATTAGIN, G.; SARMATI, L.; SORDILLO, P. *et al*. Complication of nasal piercing by Staphylococcus aureus endocarditis: a case report and a review of literature. Cases Journal 3, 37, 2010.

CASTILLO, M. Imaging of the upper cranial nerves I, III–VIII, and the cavernous sinuses. Magnetic Resonance Imaging Clinics of North America, 10(3), 415–431. 2002.

CASELLA, A.M.B. *et al*. Regeneração aberrante do nervo do oculomotor após tromboflebite do seio cavernoso. Arq Bras Oftalmol 1988;51:135-137

DE KLEER, N.; COHEN, M.; SEMPLE, J. *et al*. Nipple piercing may be contraindicated in male patients with chest implants. Ann Plast Surg 2001 Aug; 47 (2): 188-90

DINI, L. I. *et al*. Trombose sépitica do seio cavernoso: relato de seis casos. Arquivos de Neuropsiquiatria, 57 (3-A): 643-648. 1999.

DINUBILE, Mark. J. Septic thrombosis of the cavernous sinuses. Archives of Neurology, vol. 5. May, 1988.

EBRIGHT, J.R.; MITCHELL, T. P.; NIAZI, A.F. Septic thrombosis of the cavernous sinuses. Archives of Internal Medicine, vol 161. Dec, 2001.

ER, N.; OZKAVOF, A.; BERBEROGLU, A.; YAMALIK, N. An unusual cause of gingival recession: oral piercing. J Periodontol 2000;71(11):1767—9.

GALLÉ, F.; VALERIANI, F.; MAROTTA, D.; DE GIORGI, A.; BARGELLINI, A.; BIANCO, A.; COLUCCI, M.E.; CONIGLIO, M.A.; DALLOLIO, L.; DE GIGLIO, O.; *et al*. What about Your Body Ornament? Experiences of Tattoo and Piercing among Italian Youths. Int. J. Environ. Res. Public Health, 18, 12429, 2021.

HERSKOVITZ MY, GOLDSHER D, FINKELSTEIN R, BAR-LAVI Y, CONSTANTINESCU M, TELMAN G. Multiple Brain Abscesses Associated With Tongue Piercing. Archives of neurology, 66(10):1292. 2009.

HOLBROOK, J.; MINOCHA, J.; LAUMANN, A. Body piercing: complications and prevention of health risks. American Journal of Clinical Dermatology, 13 (1): 1-17. 2012.

HUNGRIA, H. Complicações das sinusites. Otorrinolaringologia. 6.Ed. Rio de Janeiro: Guanabara, 1991:56-59

KHATRI, I.A.; WASAY, M. Septic cerebral venous sinus thrombosis. Journal of the Neurological Sciences. doi: 10.1016/j.jns.2016.01.035. 2016.

KLUGER, N.; MISERY, L.; SEITÉ, S., TAIEB, C. Body piercing: a national survey in France. Journal of Dermatology. 235(1): 71-8. doi: 10.1159/000494350. 2018.

KLUGER, N.; SEITÉ, S., TAIEB, C.The prevalence of tattooing and motivations in five major countries over the world. The Journal of the European Academy of Dermatology and Venereology, 33(12): e484-e6. doi: 10.1111/jdv.15808. 2019.

KOJAN, S.; AL-JUMAH, M. Infection related cerebral venous thrombosis. J Pak Med Assoc. 2006;56(11):494-7.

LANA, M. A. e BARBOSA, A. S. Síndrome do seio cavernoso: estudo de 70 casos. Arquivos Brasileiros de Oftalmologia [online], v. 61, n. 6 , pp. 635-639. 1998.

MARIANO, A. *et al*. Endocarditis and meningitis associated to nape piercing in a young female: a case report. Le Infezioni in Medicina, n. 3 (275-279). 2015.

MARTINELLO, R.A. E COONEY, E.L. Cerebellar Brain Abscess Associated with Tongue Piercing. Clinical Infectious Diseases, Volume 36, Issue 2, Pages 32-34, 2003.

MESSAHEL, A.; MUSGROVE, B. Infective complications of tattoing and skin piercing. Journal of Infection and Public Health, 2, (7-13). doi:10.1016/j.jiph.2009.01.006. 2009.

NICOLAS, J., SOUBEYRAND, E., JOUBERT, M., LABBÉ, D., COMPÈRE, J. F., VERDON, R., & BENATEAU, H. Thrombophlebitis of the sigmoid sinus after tongue piercing: a case report. Journal of oral and maxillofacial surgery: official journal of the American Association of Oral and Maxillofacial Surgeons, 65(6), 1232–1234. 2007.

PAVIOVICH, P.; LOOI, A.; ROOTMAN, J. Septic thrombosis of the cavernous sinus: two diferent mechanisms. Orbit, 25: 39–43. 2006

PERKINS, C. S., MEISNER, J., & HARRISON, J. M. A complication of tongue piercing. British dental journal, 182(4), 147–148. 1997.

RAZEK, A.A.K.A.; CASTILLO, M. Imaging lesions of cavernous sinus. American Journal of Neuroradiology, n. 30. Mar, 2009.

SCATIGNA, M.; MASOTTA, V.; CESARINI, V.; RENZETTI, P; PETRUCCI, C.; LANCIA, L.; E LEUTER, C. Sociocultural overview and predisposing factors of body art in a health promotion perspective: survey on a sample of Italian young adults. Annali di igiene : medicina preventiva e di comunita, 2022.

SAADATNIA, M. *et al*. Cerebral venous sinus thrombosis risk factors. Int J Stroke. 2009;4(2):111-23.

SIMON, RP. Parameningeal infections. In Bennett JC, Plum F (eds). Cecil textbook of medicine. 20 Ed. Philadelphia: Saunders, 1996:2080-2085

SEKHAR, L.N. Carotid-cavernous sinus thrombosis caused by Aspergillus fumigatus. J Neurosurg. 1980;67:219-222.

SOUTHWICK, F.S.; RICHARDSON, E.P.; JR SWARTZ, M.N. Septic thrombosis of the dural venous sinuses. Medicine (Baltimore). 1986;65(2):82-106.

TRABACHNICK, T.T.; LEVINE, B. Mucormycosis of the craniofacial structures. J Oral Surg 1975; 33:464-469.

UDAONDO, P.; GARCIA-DELPECH, S.; DÍAZ-LOPIS, M.; SALOM, D.; GARCIA-POUS, M. e STROTTMANN, J. M. Bilateral intraorbital abscesses and cavernous sinus thromboses secondary to Streptococcus milleri with a favorable outcome. Ophthalmic Plastic And Reconstructive Surgery, 24(5), 408–410. 2008.

WALKER, G. W., e AWTREY, H. Infections in the Danger Area of the Lips, Face and Nose. California And Western Medicine, 48(6), 427–430. 1938.

YARRINGTON, C.T. The prognosis and treatment of cavernous sinus thrombosis. Ann Otol Rhinol Laryngol 1961;70:263-267.

YARRINGTON, C.T. The orbit in relation to rhinology. Proc R Soc Med 1977;70:456-459

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