CZU: 616.714.1-089.888.5-06:616-022.7

SURGICAL SITE INFECTIONS IN OPEN CRANIOTOMY – A SYSTEMATIC LITERATURE REVIEW

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Introduction

Open craniotomies are performed in the neurosurgical field despite the availability of other techniques in this anatomical region. Surgical site infections (SSI) are common nosocomial entities for each specialty but a higher regard is given to the above-mentioned approach. Although the antibiotic resistance is posing a threat for the health system some medical field experts are regarding other methods in order to prevent a surgical site infection (SSI). It is well regarded that such conditions can prolong the time of hospital stay while it is noteworthy that there are no perioperative infections in the surgical implantation of the neurostimulator devices for Parkisons Disease and they are rather caused by open craniotomies. Brain abscesses may sometimes progress into glioblastomas according to recent scientific reports, with a lack of clear evidence for this statement. Imaging methods do not influence the clinical outcome in the means of nosocomial infections while craniotomies do.

Goal

Emphasization of the importance of surgical site infections (SSI) in open craniotomies.

Materials and methods

After writing the keywords 'infection' and 'open craniotomy' in the PubMed database on 13.04.2024 we have received 191 sources from which we have included 64 relevant studies based on inclusion/exclusion criteria. We included articles published during 2014-2024, were statistically relevant with a consideration for surgical site infections in a craniotomy and had no conflict of interests. The excluded sources were made on animals, considered different surgical interventions, were protocol validations and took into consideration odontogenic infections.

Results

A series of influencing factors were regarded for the surgical site infection (SSI) and those are – male gender, previous surgery, subgaleal drainage of pathologic collections, foreign materials, and ventricular openings.

In order to avoid open craniotomies, the laser interstitial thermal therapy (LITT) may be performed, and sometimes may even be followed by such a craniotomy in order to diminish the sequellae of surgical interventions like glioma resection. It must be noted that repeated surgical interventions are not proven to provide significant improvement. Radiosurgical interventions can be augmented by a laser interstitial thermal therapy (LITT) in order to avoid its complications. Repeated trepanations can lead to infections without the resolution of the primary pathologic condition. Bedside percutaneous three millimeter twist-drill trephination is an alternative to the classical one that is safer and more effective. Brain biopsies are not proven to cause nosocomial infections. The transpalpebral approach is proven to have less postoperative infections.

The microscopic method does not have a higher infectivity then the endoscopic one in neurosurgery while it is proven that neuroendoscopy is relatively inoffensive in a cranioplasty performed in children (0.4% infection rate against 6.2% in the open craniotomy) while posttransfusional infections are uncommon. Frontal sinus reconstructions decrease the incidence of postcraniotomy infections.

Several comorbidities (pneumonia, sinusitis, otitis media) can be exacerbated after surgical interventions and lead to a secondary infection. Cerebrospinal fluid (CSF) leakage from the dura mater is associated with higher rates of infection while the closure technique is not related to this. Brain abscesses, neurocysticercosis, cerebral toxoplamosis, mycotic aneurisms, nasal dermoids, encephalitis, Pot Puffy's tumour, multiloculated hydrocephalus, and arachnoid cysts are the specific complications and/or exacerbations characteristic for this region in case of surgical involvement. The preauricular sinus is an anatomical anomaly that can become infected and resemble the clinical signs of a surgical site infections (SSI) or systemic infections. Seizures can be caused both by antibiotic overdose, and cerebral abscesses.

Staphylococcous aureus, and *Escherichia coli* are the predominant bacteria found in cerebral abscesses. Posttraumatic injury sites are infected mostly with *Staphylococcous aureus*, and *Klebsiella pneumoniae*. Aspergilloma, zygomycosis, chromomycosis, cryptococcoma, mucormycosis, and candida infections were the most prevalent intracranial fungal infections. *Acinetobacter baumanii* is a well-known highly resistant bacteria that may cause severe intracranial infections. The less known *Lactococcus lactis cremoris* is not aggressive but often neglected by clinicians in the context of surgical site infections (SSI). The nasal microbiome is an independent factor for infection in the patients with elective surgery.

Gelatin sponges, drainage systems in the ventricular system with continuous irrigation, and pericranial flaps are reducing the incidence of surgical site infections (SSI). It must be regarded that extraventricular drainage is increasing the likelihood of a postoperative infection. Vancomycin is a trending antibiotic for the treatment of pediatric and adult surgical site infections (SSI) after an open craniotomy. Tigecycline delivered via nanoparticles through the blood brain barrier (BBB) is the elective anibiotic in infections with *A. baumanii*. Overall a better outcome is obtained if the patients are discharged the same day as they were operated.

Conclusions

Surgical site infections (SSI) in open craniotomies remain significant threats to the postoperative patients and are a limiting factor for the development of better postoperative outcomes like recurrence, and the quality of life (QOL).

Keywords: Surgical site infections, open craniotomy, neurosurgical complications