

Factors associated with surgical site infection in blast-induced traumatic brain injury

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To the Editor: Surgical site infection (SSI) after the neurosurgical operation, while uncommon, is a serious complication. The prevalence of SSI has been reported in a range between 0.5% and 8.0%,^[1,2] and the risk for SSI was independently associated with the number of operations (>1), cerebrospinal fluid (CSF) drainage, duration of operation more than 4 h, CSF leakage, venous sinus entry, American Society of Anesthesiologists score more than 2, gender, surgical purposes (non-traumatic), and other infections.^[3] CSF leakage, lumbar, and extraventricular drainage were independent risk factors of SSI identified with regard to traumatic brain injury.^[4] In terms of the continuing conflict in southern Thailand, the patients injured from blast-induced traumatic brain injury (bTBI) have been reported.^[4-6] The blast effects can cause injuries, including open-scalp wounds, skull fractures, dural tearing, and CSF leakage.^[6,7] Such a wound that becomes contaminated results in SSI.^[7] From the literature review, there appears to be a lack of studies concerning the factors associated with SSI in bTBI. The aim of this study is to explore the clinical and neuroimaging parameters associated with SSI in patients with bTBI.

The authors conducted a retrospective review of the database of the trauma registry at the tertiary trauma center. The registry has recorded data concerning all traumatic cases who received treatment in our hospital. This report included a sample comprising 80 patients with bTBI who received operations at the tertiary trauma center from 2009 to 2019. Several clinical, laboratory, treatment, and radiological factors were collected for analysis. Initial Glasgow coma scale score on arrival was divided according to severity. Using computed tomography (CT) scan of the brain, the intracranial injuries, pressure effects, and infectious signs on neuroimaging, and other characteristics were reviewed by two neurosurgeons. Diffuse swelling is defined as cistern compression and midline shift greater than 5 mm. The outcome of the study was SSI,

which was evaluated at 90 days after neurosurgical procedures. According to the SSI criteria of the Centers for Disease Control and Prevention, SSIs were classified as superficial incisional SSI, deep incisional SSI, and organ/space SSI.^[8] The study was performed with the permission of the ethical committees (REC.61-385-10-1). In both univariate and multivariable analysis, the binary logistics regression was applied to estimate the predictors of death. In multivariable analysis, the forward method was used to establish whether or not predictors deserved to be included in the model. Statistical analysis was performed using the R Statistical Software version 3.5.0 (R Foundation, Vienna, Austria).

The baseline characteristics of the 80 patients with bTBI are shown in Supplementary Table 1, <http://links.lww.com/CM9/A100>. Almost all patients were male, and 67.5% were military personnel. In terms of severity, 40.0% of patients were deemed severe TBI, while 46.3% had mild TBI. Scalp lacerations/contusions were observed in 51.3% of all patients, while secondary brain insults, particularly hypotension and hypoxia, were observed in 22.5% and 15.0% of all patients, respectively. According to the definition of Rosenfeld *et al*,^[9] the most common blast effect was penetrating blast effect in 53.8% of all patients. Therefore, patients frequently suffered from contaminated projectiles and penetrating bone fragments. From the neuroimaging findings in Supplementary Table 2, <http://links.lww.com/CM9/A100>, depressed skull fractures and coup contusions were the common intracranial pathologies. Midline shift over 5 mm and basal cistern obliteration were observed in 20.0% and 17.5% of the patients, respectively. Moreover, foreign bodies included metallic, bone, and wooden fragments in 14 (17.5%), 9 (11.2%), and 1 (1.2%) of the patients, while post-operative retained foreign bodies were observed in 10 (12.5%) patients after CT scan of the brain. Moreover, post-operative CSF leakage was observed in one individual.

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The major primary procedure was craniotomy with clot removal/debridement in 35.0% of the patients, while decompressive craniectomy with/without clot removal/debridement was the procedure in 12.5% of the patients. All procedures received the antibiotic prophylaxis. In the present report, SSIs were observed in 5.0% of the patients, all of which were brain abscesses (organ/space type) without meningitis/ventriculitis. Also, the microorganisms of SSIs in the present cohort were *Acinetobacter baumannii* (25%), *Staphylococcus aureus* (25%), and sterile purulent discharge (50%). The surgical operations with abscess removal were performed in all of the SSI cases. Therefore, the post-operative antibiotic injection was used continuously for 12 weeks. The results from the binary logistics regression analysis are summarized in Supplementary Table 3, <http://links.lww.com/CM9/A100>. The retained foreign body was a factor significantly associated with SSI (odds ratio: 35.0, 95% confidence interval: 3.13–390.41). Because only one factor was a significantly associated factor, the multivariable analysis was not performed.

In conclusion, bTBI tends to develop SSI from the contamination of wounds and foreign bodies. The results herein could guide decision making for future treatment. Accessible foreign bodies should be removed as completely as possible to eliminate or mitigate the source of infection.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflicts of interest

None.

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