Trauma or injury to the frontal lobe of your brain can cause a wide range of problems and changes to your personality. That’s because the frontal lobe is responsible for shaping social behavior and personal characteristics. It controls things such as personality, decision-making, motivation, and voluntary movements. This article discusses the functions of the frontal lobe and how it can be injured. It also covers the long-term effects of frontal lobe injuries and how they can be treated. Caiaimage / Trevor Adeline / Getty Images The brain is divided into lobes, or sections: frontal, parietal, occipital, temporal, limbic and insular cortex. The frontal lobe lies at the front of the brain. It starts right behind the eyebrows, traveling up the forehead, and covering about a third of the top of your head. The left and right sides of the frontal lobe handle some different functions and this can sometimes vary per person. The right frontal lobe is primarily associated with non-verbal skills, such as interpreting social cues or observing people’s reactions. The left frontal lobe generally has greater control over speech. However, about one-third of people who are left-handed have speech function located on the right side instead of the left. The right and left sides of the frontal lobe communicate with each other. The frontal lobe is in the front part of the brain. The right frontal lobe generally handles non-verbal skills while the left frontal lobe generally controls speech function, yet some people who are left-handed have their speech controlled by the right side. The frontal lobe is one of the most common areas of the brain to be affected by head trauma. Common causes include the head being hit by: A car dashboardFront handlebars of a bicycleThe ground when thrown from a motorcycleA tree or other immobile object during sportsAn assailant using a blunt object If the skull fractures, it’s called an open injury. An open skull fracture over the frontal lobe may push bone fragments into brain tissue. It also increases the risk of infection, because bacteria, fungi, and other infectious organisms can come into contact with the brain. A closed frontal lobe injury means that the skull was not broken or punctured. The damage to the brain may still be serious if the impact caused bleeding or tearing of any of the nerves and tissues. Damage to the frontal lobe can lead to a variety of personality and behavioral changes. Some that may impair learning include: Attention and concentration problemsDifficulty solving complex problemsLanguage difficultySlowed critical thinking Altered social behaviors may include: Impatience and intolerance of othersImpulsive, dangerous behaviorsVerbal and physical outburstsPoor judgementNegativityApathyRigidity and inflexibilityEgocentricity Other problems may be more medical in nature, such as: DepressionInsomniaSubstance abuseImpaired movement Frontal lobe damage from head trauma manifests in many different ways. This can depend on the severity of the injury, what sections of the frontal lobe were injured, and pre-existing personality traits. With head trauma or brain injury, the first steps of treatment focus on stopping bleeding and managing swelling and nerve death. A number of diagnostic tools can help assess head trauma and brain injury. It’s common to have a CT scan (computed tomography) immediately after the injury. The CT scan produces a three-dimensional image to show more detail of skull fractures or bleeding. Next, a magnetic resonance imaging (MRI) scan may be used to further identify which areas of the brain suffered damage. If serious bleeding leads to pressure on the brain, surgery may be needed to stop the bleeding and remove the blood. An open fracture may need to be surgically repaired. Any foreign bodies that entered the brain need to be removed. Bleeding has to be stopped, and the wound needs to be stabilized and closed. After a frontal lobe injury, rehabilitation is an important part of recovery. Since the front part of the brain is closely related to behavior, a neuropsychologist may conduct personality and skill tests. These tests help determine which skills need re-training. Interviews with the patient, family, and friends help the medical team and therapist understand how the injury changed the person. From there, the medical team will put together a brain injury rehabilitation plan. The goal is to bring the person as closely back to their original functional state as possible. The frontal lobe is located at the front of the brain. Trauma or injury to this part of the brain can cause personality and behavior changes. It can cause attention problems, language difficulty, impulsive behavior, and inappropriate social behavior. Frontal lobe trauma may require surgery if there’s bleeding or any foreign objects in the brain. After your condition is stabilized, rehabilitation is an important part of recovery. Your medical team will evaluate your injuries and develop a brain rehabilitation plan to help you regain skills. Original Article Comparison of the Surgical Approaches for Frontal Traumatic Intracerebral Hemorrhage Eun Sung Park, M.D., Seong Keun Moon, M.D., Ph.D., Ki Seong Eom, M.D., Ph.D. Journal of Trauma and Injury 2019;32(2):71-79. DOI: Published online: June 30, 2019 5,848 Views 114 Download 4 Crossref Department of Neurosurgery, Wonkwang University Hospital, Iksan, Korea Correspondence to: Ki Seong Eom, M.D., Ph.D., Department of Neurosurgery, Wonkwang, University Hospital, 895 Muwang-ro, Iksan, 54538, Korea, Tel: +82-63-859-1467, Fax: +82-63-852-2606, E-mail: kseom@wonkwang.ac.kr • Received: January 18, 2019 • Revised: March 18, 2019 • Accepted: April 8, 2019 Copyright © 2019 The Korean Society of Trauma This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited. Purpose Recent developments in minimally invasive techniques have the potential to reduce surgical morbidity, promote patient recovery, accelerate surgical procedures, and thus improve cost-effectiveness in case management. In this study, we compared the treatment efficacy and results of supraorbital keyhole approach (SOKA) with those of conventional unilateral frontal craniotomy (CUFC) for traumatic intracerebral hemorrhage (TICH) in the frontal lobe. Methods We analyzed the data of 38 patients who underwent CUFC (n=30) and SOKA (n=8) and retrospectively reviewed their medical records and radiological findings. Furthermore, we tried to identify the best surgical method for such lesions by including patients who underwent burr hole aspiration and drainage (BHAD) (n=9) under local anesthesia due to various circumstances. Results The difference in the initial Glasgow coma scale score, operative time, and length of hospitalization between the CUFC and SOKA were statistically significant. All radiological features between the two groups including associated skull fracture, amount of pre- and postoperative hematoma, percentage of complete hematoma removal, pre- and postoperative midline shifting of the hematoma, and development of postoperative delayed hematoma were not statistically significant. Our experience of 46 patients with TICH in the frontal lobe with any of the three different surgical methods including BHAD enabled us to obtain valuable findings. Conclusions Although it is difficult to insist that one particular approach is more useful than the other, we are confident that SOKA will have more advantages over CUFC in carefully selected patients with frontal TICH depending on the surgical experience of a neurosurgeon. Traumatic intracerebral hemorrhage (TICH) or contusion occurs in up to 15% of the patients after traumatic brain injury (TBI) [1]. TICH commonly occurs in the frontal lobe following trauma; however, studies focusing on the effects of TICH in the frontal lobe is limited, except for some case reports [2,3]. Although there is no consensus on the various surgical approaches for TICH in the frontal lobe, we believe that frontal craniotomy through bicoronal incision is most likely to be performed. Conventional frontal craniotomy or craniectomy through bicoronal incision can effectively evacuate the hematoma and reduce intracranial pressure (ICP) in patients with severe brain swelling. However, these approaches have disadvantages, such as a longer operative time, more tissue damage, and increased intraoperative blood loss [3,4]. Advances in neuroimaging techniques such as microscopy, neuroendoscopy, and neuronavigation have enabled the performance of minimal invasive surgery. Recent developments in minimally invasive techniques have the potential to reduce surgical morbidity, promote patient recovery, accelerate surgical procedures, and thus improve cost-effectiveness in case management [3–5]. In this study, we compared the treatment efficacy and results of supraorbital keyhole approach (SOKA) with those of conventional unilateral frontal craniotomy (CUFC) for TICH in the frontal lobe. Furthermore, we tried to identify the best surgical method for such lesions by including patients who underwent burr hole aspiration and drainage (BHAD) under local anesthesia due to various circumstances. Data collection and exclusion criteria From February 2011 to September 2017, 59 patients underwent operation for unilateral or unilateral dominant bilateral TICH in the frontal lobe at our institute. Of these, we excluded 13 patients who underwent decompressive craniectomy because they often had various concomitant extracranial or brain stem injuries, severe brain injury other than those in the frontal lobe, and had poor neurological condition. Moreover, we excluded eight patients who underwent BHAD because the patients’ family did not consent to the operation under general anesthesia due to their circumstances, such as old age, poor health, financial situation, and various other difficult situations. In addition, this BHAD group is considered in the discussion section. We analyzed the data of 38 patients who underwent CUFC (n=30) and SOKA (n=8) and retrospectively reviewed their medical records and radiological findings. We also discussed indications, advantages, and disadvantages for each surgical approach including BHAD (n=9). Surgical approach The patients were placed in a supine position, with body slightly upright and the head in 15–20° retroflexion. Then, a bicoronal bow-like skin incision was made. The skin flap was then retracted anteriorly-inferiorly, and this flap was dissected in the subgaleal plane until the proximal ends of the superciliary arches were reached. At this instance, the pericranium can be raised as a separate, anteriorly pedicled vascularized flap for reconstructive purposes. One burr hole was positioned in the lateral part behind the supraorbital rim. The two additional burr holes positioned at least 1 cm away from the midline can be used to avoid injury to the superior sagittal sinus. The dura mater was suspended and incised in a curved fashion. The base of the curved incision was oriented towards the eyeball. The contused brain tissue and any hematomas were visualized under a microscope and carefully removed. Strict hemostasis was performed in the surgical field. A drainage tube was inserted after surgery (Fig. 1). The patient’s head was placed supine on a horseshoe headrest. Then, depending on the location of the lesion, the patient’s head is turned 10–25° to the contralateral side to achieve a straight surgical trajectory and bent 10–15° posteriorly to achieve the gravity-related self-retraction of the frontal lobe from the skull base. Subsequently, approximately 4 cm skin incision was started lateral to the supraorbital foramen within the eyebrow, extending laterally to the frontal process of the zygomatic bone following the orbital rim. The temporalis muscle was dissected restrictedly along the superior temporal line to expose parts of the frontal process of the zygomatic bone. By using a high-speed drill, a single fronto-basal burr hole was made lateral to the temporal line. Small frontotemporal craniotomy was made parallel to the orbital rim. After removal of the bone flap, the inner edge of the craniotomy is drilled above the orbital rim, increasing intracranial manipulation. The dura is opened in a curved shape and retracted in a basal direction. Hematomas were evacuated carefully under a microscope. In some cases, a neuroendoscope was used to remove hematomas located in areas not visible under a microscope. After gross total removal of hematoma and contused brain, a gelatin–thrombin matrix sealant (FloSeal©; Baxter Inc, Deerfield, IL, USA) was used to facilitate the complete hemostasis. The dura mater was sutured roughly and covered using a suturable dural onlay graft (Lyoplant®; Braun, Aesculap, Tutsingen, Germany) (Fig. 2). Clinical data Thirty-eight patients were categorized into two groups (i.e., CUFC and SOKA), and the following demographic and clinical characteristics obtained from the hospital records were compared and analyzed: age, gender, concomitant extracranial injury, cause of injury, Glasgow coma scale (GCS) score at admission and discharge, operative time, length of hospitalization, and mortality. Moreover, we investigated the radiological differentiations based on brain computed tomography (CT) between the two groups, including associated skull fracture, pre- and postoperative day 1 amount of TICH, complete removal of TICH, pre- and postoperative day 1 midline shifting, and postoperative delayed hematoma. The TICH volume was calculated based on a non-enhanced CT image using the formula A×B×C/2, where A, B, and C represent the dimensions of CT hyperdensity in three axes perpendicular to each other [2,6]. Statistical analysis SPSS version 22.0 (IBM SPSS Inc., Armonk, NY, USA) was used for statistical analyses. Categorical variables were assessed using Pearson’s and Fisher’s exact tests, and continuous variables were assessed using the Mann-Whitney U test. A p-value of less than 0.05 was considered statistically significant. Comparison of clinical characteristics Overall, 38 patients with TICH in the frontal lobe were included in this study. The clinical characteristics of both groups are summarized in Table 1. The mean age of the CUFC group was higher than that of the SOKA group (64.6 vs. 57.6 years, respectively). Of the patients, 28 (73.7%) were men and 10 (26.3%) were women, and the frequency of TBI in men was higher than that in women. The rate of concomitant extracranial injury was similar for CUFC group (23.3%) and SOKA group (25%). The difference in age, sex, and concomitant extracranial injury between the two groups were not statistically significant (p=0.265, p=1.000, and p=1.000). The most common cause of injury was a slip (50.0%; n=19), followed by traffic accident (34.2%; n=13), and falls (15.8%; n=6). The initial GCS score of the CUFC group (9.8±3.3 years) was lower than that of the SOKA group (14.0±1.5 years). Operative time and length of hospitalization of the CUFC group (214.1±80.4 minute and 31.6±26.7 days) was also shorter than that of the SOKA group (76.6±6.4 minute and 10.5±1.5 days). The difference in the initial GCS score, operative time, and length of hospitalization between the two groups were statistically significant (p=0.002, p