

Implantation of a Licox Probe Resulting in Insertion & Rigid Fixation in Early Magnetic Resonance Imaging

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Abstract

The management of comatose patients with acute brain injury necessitates the use of continuous bedside oxygen monitoring of brain tissue. In order to avoid patients suffering from secondary ischemia, it has been established that maintaining adequate brain oxygenation is an essential objective in neurocritical care. Because subarachnoid hemorrhage and traumatic brain injury patients frequently require early magnetic resonance imaging, conventionally implanted metal bolts have major artifacts that are disadvantageous. The feasibility of a novel technique of bedside implantation of a Licox brain tissue oxygenation probe, resulting in a length-adjustable insertion and rigid fixation without metal artifacts in early magnetic resonance imaging, is presented in this paper. The implantation of a Licox brain tissue oxygenation probe with a peripheral venous cannula that is placed through a plastic bolt placed on a burr hole.

Keywords: Brain tissue oxygenation; Neuromonitoring

Introduction

In the treatment of comatose patients with acute brain injury, continuous bedside brain tissue oxygen monitoring (BTOM) is an essential component. In order to avoid patients suffering from secondary ischemia, it has been established that maintaining adequate brain oxygenation is an essential objective in neurocritical care. A correlation between BTOM and outcome has been demonstrated following subarachnoid hemorrhage and traumatic brain injury. Traditionally, insertion of the probe into brain parenchyma can be performed in 2 different ways. In the majority of cases, especially in subarachnoid hemorrhage with coiled aneurysms, bedside implantation is performed [1-3]. It requires a burr hole with single or multiple lumen metal bolt provided by the manufacturer. The probe is then inserted through the bolt with a predetermined length of approximately 3 cm beneath the skull.

Alternately, the probe can be inserted during surgery into the operative field. Because the probe is tunnelled subcutaneously, intraoperative implantation following craniotomy or craniectomy does not require bolt implantation. The probe is then sutured directly to the skin after its tip is inserted into the brain parenchyma. The Licox probe can be connected to a plastic cannula during surgery in other ways that have been described previously. However, intraoperative probe placement is only possible during surgery and is not possible before or after [4]. The most common bedside implanted metal bolts are disadvantageous due to massive artifacts because traumatic brain injury patients frequently require early MRI. Due to the probe's predetermined insertional length, it is also more difficult to target the probe's tip in the cerebral parenchyma area of interest. This might have an effect on BTOM, especially in areas near watersheds that are at risk. As a result, we present a novel method for implanting a brain tissue oxygenation probe at the bedside using a peripheral venous cannula that is inserted through a plastic bolt from a different manufacturer. This allows for a rigid fixation and a length-adjustable insertion without the metal artifacts that were present in earlier MRIs.

The patient is situated on an emergency unit ordinary medical clinic bed in recumbent situation with 30 levels of head rise and a kidney bowl under the neck for adjustment against the sleeping cushion. Tape is used to secure the head to the bed frame [5-7]. The insertion point is typically marked approximately 1 cm lateral to the Kocher

point and disinfected using Octeniderm depending on the desired probe position. A cranial hand drill is used to create a burr hole with a diameter of 5.8 mm after a skin incision of 5 mm is made. The burr hole is then securely secured with a Raumedic plastic bolt, manufactured by Raumedic AG in Münchberg, Germany. The dura is punctured with a standard 14-check venous cannula. The inner needle is removed, but the cannula is left in place. The Licox probe is inserted into the brain parenchyma through the plastic cannula's lumen. The peripheral venous cannula is connected to the proximal end of the probe at this point by slowly pulling it back about 3 cm. The distance between the pulled-back cannula's end and the bolt's rim is approximately 1 cm, but this distance may vary depending on the brands of bolt and cannula as well as the target position for the Licox probe's tip. Sutures are used to secure the cannula's wings and probe to the scalp. In order to secure the bolt more securely, the lumen is tightened.

The bolt cannot be inserted into the skull using hand power because of its high resistance, so it is safe to do so. After connecting the peripheral venous cannula to the probe, it should be fixed with multiple sutures on the plastic cannula's wings and distal lumen to reduce the risk of dislocation during nursing and positioning changes. By suturing a pad between the skin and the cannula wings, galea protection can be made easier. The Raumedic bolt as a one-lumen system. In the event that different tests are required, for example, a Licox test and a parenchymal intracranial strain test, an extra burr opening should be bored with implantation of a subsequent bolt. Because of weakness of the Licox test, it is prescribed to fix the lumen of the Raumedic bolt just with delicate strain to keep it from crimping [8]. The probe is not damaged or kinked by deflection at the bolt's entry. The screw force of the bolt cap can be adjusted to prevent cerebrospinal fluid leakage in the rare event of high intracranial pressure. The angle of the burr hole

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determines how the probe is inserted when aiming at specific brain regions. Before implantation, computed tomography imaging must be used to determine the depth. Because the venous cannula can be inserted through the skin to the brain parenchyma, this procedure can be performed without the use of a plastic bolt in patients who require secondary BTOM following a decompressive craniectomy.

Discussion

We talk about how Licox probes can be inserted at the bedside without the metal bolt that was previously required. In patients who require BTOM probe implantation at the bedside; this method is safe and reliable. It is suggested in torpid patients with extreme awful mind injury and aneurysmal subarachnoid drain in danger of auxiliary localized necrosis and vasospasm, without the sign for pressing a medical procedure. Due to the elimination of massive metal artifacts, patients who may receive an early MRI for the purpose of adjusting treatment strategies and predicting neurologic outcomes will gain [9-10]. The 1.5 Tesla Licox probe has been approved by the U.S. Food and Drug Administration and is MRI conditional. In addition, this method makes it easier to guide the probe's tip into a specific intraparenchymal location that is either deeper or shorter than the predetermined length of 3 cm below the skull. Since 2017, the described procedure has been used on more than fifty patients without causing any relevant complications. The measurement values were as accurate as when using the standard method with a metal bolt. As soon as patients were no longer at risk for vasospasm and secondary ischemia, the Licox probes were removed.

Conclusion

The Licox brain tissue oxygenation probe and venous cannula can be safely and reliably inserted through a plastic bolt, resulting in a rigid

fixation and length-adjustable insertion without metal artifacts in early MRI.

Declaration of Competing Interest

The authors declared that there is no conflict of interest.

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