CORRESPONDENCE

Cerebral Parenchymal Probe Placement with Extreme Limitation of Cranial Bone

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Abstract

Neurocritical care monitoring is prudent for the close neurological evaluation and adjustment of the treatment. Neuromonitoring allows the identification and evaluation of various physiological variables that can be modified after the primary injury. In severe TBI management, the use of intracranial probe is part of the advanced management of the neurocritical patient. Decompressive craniectomy, focal brain surgery, fracture skull, and previous prothesis makes it extremely tricky to achieve cerebral parenchymal probe placement (PPP).

Keywords: Brain, Neurocritical care, Neuromonitoring.

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Neurocritical care monitoring is prudent for the close neurological evaluation and adjustment of the treatment. Neuromonitoring allows the identification and evaluation of various physiological variables that can be modified after the primary injury.[1] In severe TBI management, the use of intracranial probe is part of the advanced management of the neurocritical patient. Decompressive craniectomy, focal brain surgery, fracture skull, and previous prothesis makes it extremely tricky to achieve cerebral parenchymal probe placement (PPP). These patients are unstable during the early phase of intensive care stay. Here we describe two patients where PPP was clinically indicated with extreme limitation of carinal bone.

Case Descriptions

Case 1

A 58-year-old right-handed patient presented to an outside hospital with wakeup stroke. His deficit was complete right-sided weakness and marked aphasia. He was out of recombinant tissue plasminogen activator (rTPA) window and his CT scan showed early left middle cerebral artery (LMCA) stroke (Fig. 1A). There was a dense clot present in the first segment of LMCA. He was sent to comprehensive stroke center for an embolectomy attempt. On arrival a perfusion magnetic resonance imaging (MRI) brain was done which confirmed no viable penumbra and major LMCA area stroke. He was intubated prior to this MRI due to decline in neurological status. He was admitted to neurocritical care unit for close neuro checks. His repeat CT scan in 12 hours showed worsen cerebral edema and shift from left to right. At that stage an emergent left side decompressive hemicraniectomy was performed. Follow-up CT brain in 6 hours showed progressive cerebral edema. His postoperative CT skull showed extremely limited bone over left frontal area (Fig. 1B). A decision was made to place PPP. Raumedic® bolt was selected. Left limited forehead area was evaluated for the access site. Sagittal images showed minimal area behind the resection and cephalad to frontal sinus (Fig. 1C). The bolt was placed with an opening pressure of 26 mm Hg. His repeat CT scan showed appropriate placement of the probe without any complications.

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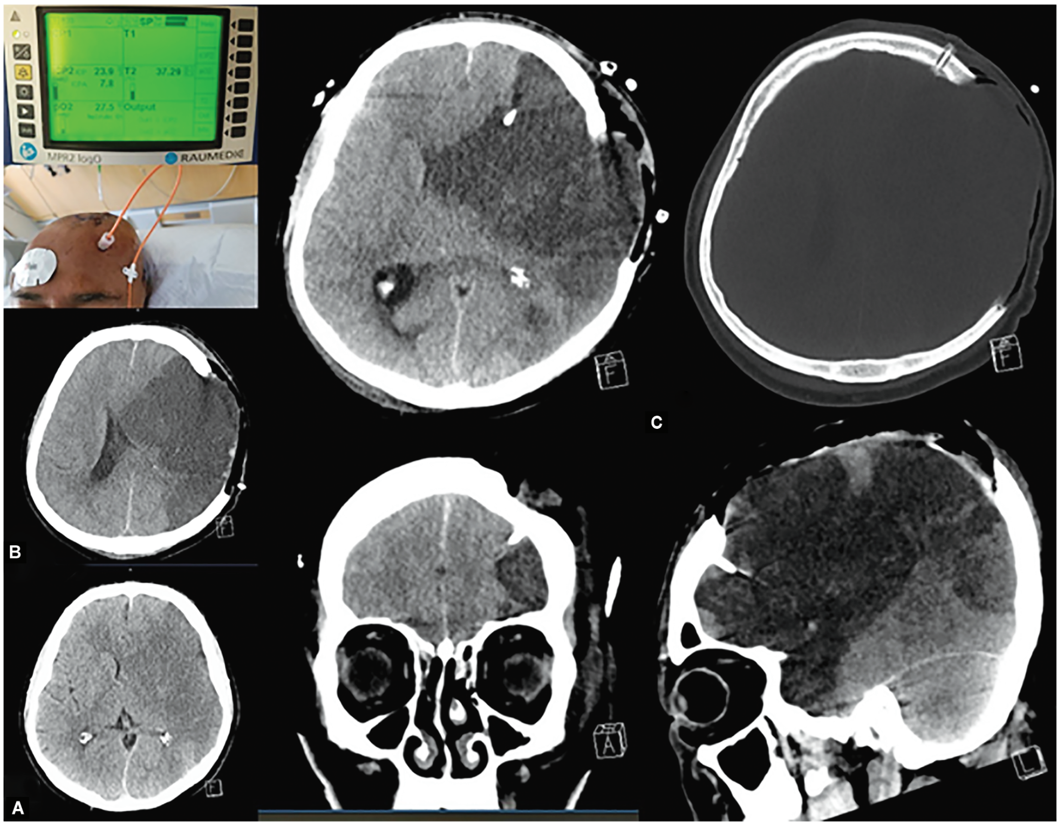
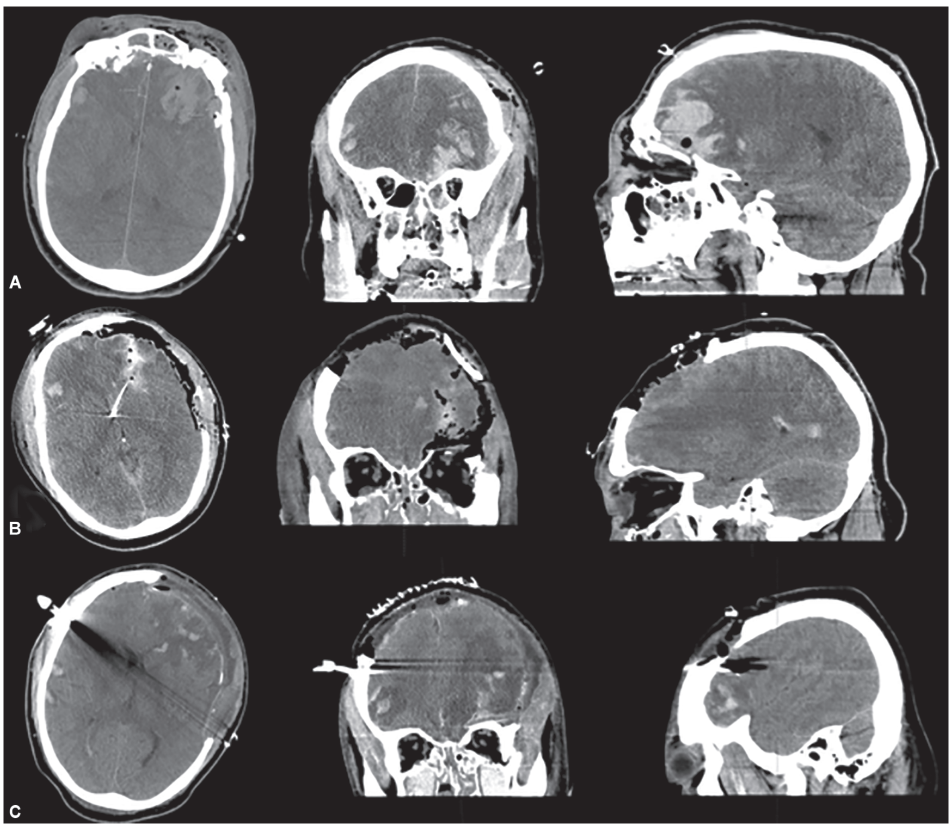
Case 2

A 43-year-old right-handed, unhelmeted bicyclist, hit by a car with GCS at the scene of 5 (Eyes 1 Motor 2 Verbal 2). The imaging findings showed an acute left frontal 20cc intraparenchymal hemorrhage, left acute subdural hematoma, bilateral temporal contusions with multiple complex facial fractures involving the inner table of the left frontal sinus as well as depressed left frontal and left temporal skull fractures with 5 mm of left to right midline shift and effaced basilar cisterns (Fig. 2A). He was immediately taken to the operating room for a left fronto-temporo-parietal craniectomy as well as right frontal craniectomy with transection of the anterior third of the superior sagittal sinus and the falx. Partial cranialization and exenteration of the left frontal sinus was also done. An external ventricular device (EVD) was placed intraoperatively utilizing a modified paine's point technique (Fig. 2B). For the first day following surgery, the patient was sedated. There were no intracranial pressure issues for the first 3 days following the trauma. However, on the third day, EVD was inadvertently disconnected at the proximal hub. Due to the increased risk of infection, the EVD was immediately clamped just as it exited the skin so as to not allow any backflow of likely contaminated cerebrospinal fluid



Figs 1A to C: CT images for presentation (A); after left-sided decompression (B); and after placement of Raumedic^{R} probe (C). Top left image showing the information obtained after placement of the probe



Figs 2A to C: (A) Presentation CT scan with severe TBI; (B and C) Post bilateral decompressive craniectomy and post CaminoR probe placement into the brain. Once the heparin had been held for 6 hours from the last dose (patient was on prophylactic 5,000 units of heparin), the EVD was removed. As we were entering the window of peak intracranial swelling following a significant traumatic brain injury, we elected to place an PPP on the right side. This was complicated by the craniectomy, as well as, the duraguard duraplasty that would obstruct any attempt to place a fiberoptic or strain gauge intraparenchymal monitor. We therefore carefully evaluated all the postoperative images and elected to place a right frontal PPP in such a way as to avoid critical structures. The procedure was performed without any complications, and a postoperative CT brain showed good placement of the strain gauge intraparenchymal catheter (Fig. 2C). This continued to read appropriate intracranial pressures, which helped during the period of peak intracranial swelling.

Optimal placement of ICP monitoring probe is important to ensure safety and acquire the correct information in neurocritical care patients. There is scarce information in the literature regarding the correct location of the intracranial probe and the technical aspects in patients undergoing surgery for cranial neurotrauma. The two common approaches for placement of probes can be followed in the same way as EVD placement. Kocher's point and Dandy's principle are used in practice.[2,3] The discussion for these approaches is beyond the scope of this paper. These patients are unstable and unable to go for navigational placement of probe. Extensive review of images and in-depth knowledge of neurosurgical anatomy help to guide bedside placement of probe. We introduce two cases with images to share our experience with neurointensivists who are taking most of the management in neurocritical care units. In both cases the management was guided with PPP and impacted bedside clinical management. Despite having been published aspects about technical specifications for ICP insertion, care and bundles. We believe that it is important to promote interest considering that post-traumatic anatomical alterations of the shell can contribute to the technical failure of the devices.[4,5] Especially during the mobilization of patients and at some stage of intrahospital transport.

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