Perfusion done at the time of presentation. Two sets of
managements were arrived at, one determined from only the
clinical presentation and the plain head CT-ASPECT score. The
second plan was determined with the added CTA and CTP
findings. These retrospective management plans were then
compared with the actual management of these patients. The
reviewing neurologists did not alter the treatment decisions
based on the CTP findings because to date, there has been no
randomized clinical trial testing CTP findings in acute stroke. So
in principle, there was no change in decision making based on
CTP information. But in practice, management of two patients
was changed based on the CTP results and other clinical
findings. In two other patients in our group, treatment did not
change the imaging outcome, which was predicted by CTP. CT
Perfusion information is being used at our center to determine
who might benefit from intra-arterial tPA on a case by case basis.

We believe that the dichotomy of the principle and practice in
implementing CTP in the care of acute stroke patients is due to
the following important reasons. Firstly, though the
physiological basis of CTP imaging findings are theoretically
sound, there is no level one evidence to support the extent to
which CTP information can change patient management.
Secondly, the experience and knowledge in interpreting CTP is
still limited. CT Perfusion is currently useful for its qualitative
evaluation of cerebral perfusion but limited in its quantitative
evaluation. This is largely due to the different post processing
algorithm followed by different vendors. Thirdly, there is no
established universal standardized protocol for CTP imaging.
Due to a lack of good evidence, no established methodology has
been established and as a result, each institution has tailored their
unique protocol.

When appropriately applied, CTP imaging can be a good
predictor of the radiological outcome of stroke. Much has been
dedicated to evaluating CTP’s theoretical underpinnings,
technical implementations and image interpretation. Clinically
however, we cannot treat the image on the screen and currently,
there is no good evidence of how CTP results can help clinicians
manage acute stroke therapy. There is still a stark principle and
practice dichotomy in its clinical application of the acute stroke
patient care. Before this modality can be incorporated into
routine clinical practice, a strong evidence base needs to be
established from which decisions can be made. We ultimately
need a well-designed randomized controlled trial. Most of the
therapeutic trials are based on the time window and have not
shown a huge benefit in terms of final outcome. We believe this
was because patients were selected based on time window, but
every patient has a unique time window.

With the wide-spread availability of CTP penumbra imaging,
we should consider incorporating the viable tissue window in
addition to (or perhaps even instead of) the time window alone
when making treatment decisions. A therapeutic trial based on
management to salvage viable tissue based on CTP penumbra
imaging instead of by time of onset is the need of the hour and
in our opinion is a move towards improved patient management.

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TO THE EDITOR

Acute Neurological Complication in Awake Craniotomy; - A
Diagnostic Dilemma

Perioperative neurological complications are less frequently
associated with patients undergoing awake craniotomies. However, sometimes intraoperative neurological events warrant
alternate diagnosis and management especially, if the cause is
not related to surgery. After obtaining written informed consent
from the patient, we have highlighted this issue.

A previously healthy young man was admitted to our hospital
for investigation and treatment of headache and seizures, for few
months duration. Magnetic resonance imaging demonstrated a
mass on left frontal lobe. As the lesion was near the speech
center, the patient was scheduled for an awake craniotomy. Surgery proceeded under monitored anesthesia care (MAC),
with intravenous infusions of remifentanil (0.05 mcg /kg/min)
and propofol (25 - 30 mcg / kg / min). All standard monitors
were attached. Cyclic measurement of noninvasive blood
pressure (NIBP) on left arm was stopped after right radial arterial
cannulation. Left sided scalp nerves block were performed. The
patient’s neck was tilted to his right side and a soft bolster was
placed under the left shoulder to preventing excessive stretch of
the brachial plexus. The patient was comfortable and mildly
sedated. At the time of tumor resection, all infusions were

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stopped to facilitate verbal communication and monitor the patient’s speech. During this time, the patient complained of weakness and numbness in his left arm. The surgeon was asked to pause the procedure and reposition the head frame and shoulder bolster, in order to reduce strain on a presumed stretched brachial plexus. Despite repositioning the head frame and adjusting the shoulder bolster, the patient continued to complain of worsening weakness and numbness in his left arm. At this point, the drapes were removed from the left arm. To our surprise, the automated blood pressure cuff was still inflated. We immediately disconnected the NIBP cord and removed the cuff. Within few seconds, all the neurological symptoms on left arm improved and there was no residual deficit. Rest of the intraoperative course was uneventful.

Perioperative neurological complications such as weakness of extremities can be manifestations of multiple etiologies including surgical factors, position related brachial plexus and other neural injuries, worsening of preexisting spine disorders, cervical disc protrusion, stroke and metabolic neuropathies. Most of the above mentioned causes were ruled out in our patient. Peripheral nerve injury is a rare anesthetic complication association with the use of an automatic blood pressure monitor. In many of these reports, patients developed neurological symptoms in the postoperative period. In our case, prolonged inflation of the cuff due to acute kinking of tubing produced ischemic nerve compression and may have provoked the patient’s neurological symptoms. Since the patient was sedated until tumor resection, he was unable to appreciate the pain or tightness on the left arm. Fortunately, there was no permanent ischemic injury, which could cause serious complications. In cases of sudden intraoperative upper limb weakness without any apparent surgical cause, one should always suspect non-surgical factors and promptly check for the neck position (extreme rotation, tension on neck muscles), extremity position (extreme flexion, abduction or adduction) and status of blood pressure cuff (inflation, impingement on cubital fossa).

In conclusion, a simple monitoring method such as NIBP can produce serious neurological complications, which, in neurosurgical cases, may be incorrectly attributed to surgical causes or inappropriate positioning. Malfunction of the NIBP should be considered in the differential diagnosis, if such an event occurs on the monitoring arm.

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