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# Surgical planning illustration for neurosurgery: A contemporary medical template

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## ABSTRACT

**Background:** Pre-operative planning is essential things of any neurosurgical procedure. Illustrative design still becomes the best way to make appropriate pre-operative planning. The purpose of this paper is to provide a basic craniotomy and patient positioning illustration template for neurosurgeons or residents in the making of appropriate surgical planning or operative view.

**Methods:** We made simple illustrations for every common head position without an incision line and also the standard position for the patient's body in every neurosurgical procedure. The case example was also described in the paper.

**Results:** Precise and easy illustration would help neurosurgeons or residents for making good surgical planning or operative view during the presentation which in turn makes it very informative for the audience. Moreover, it would also help practitioner to imagine the surgical approach before and during the surgery.

**Conclusion:** Surgical illustration may serve as an educational and informative tool with potential instructional value in clinical practice especially for neurosurgical residents or trainees.

**Keywords:** neurosurgery, pre-operative planning, surgical positioning, surgical approach, surgical illustration.

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## INTRODUCTION

Surgical success thus begins long before the surgeon sets foot in the operating theater. The goals of surgery should always be considered as they relate to the patient's overall medical status and personal preferences. Because the nervous system has little tolerance for injury, the axiom "failing to prepare is preparing to fail" holds particularly true. Comprehensive planning represents the first priority and foundation of any neurosurgical procedure.<sup>1,2</sup>

Despite technological advances in documentation in medicine, from planning the surgery to depicting every step of the operation and also archiving the surgical technique or method, illustrations remain a leading position in medical education.<sup>3,4</sup> The neurosurgeon, including staff, trainee, and or resident, needs to have the ability to communicate the best surgical planning design, however, not all of them have the capability to draw an appropriate surgical picture even in a simple way.

The aim of this paper was to bridge the gap between the learning processes of the neurosurgeon in the clinical settings and

making a good presentation in the current digital era also upgrading clinical practice quality, particularly in the surgical planning.

## METHODS

We presented six templates figure of the patient's body and nine head routine positioning in neurosurgical operation, illustrated by the author (M.K). We made a simple semi-realistic style template for every head position option for the cranial approaches without an incision line or another artifact, so the operators of the surgery could use them to design the best surgical position and the incision line in digital or manual ways. For example, by using Microsoft<sup>®</sup> power point presentation, Microsoft Word<sup>®</sup>, or another picture editing software i.e. Adobe Photoshop<sup>®</sup>, the user might easily edit, design the incision line and approach strategy and may also present the illustration to the attendee or participant for example in the operation theater and in the live streaming webinar. Two cases have been selected for examples of the illustration.

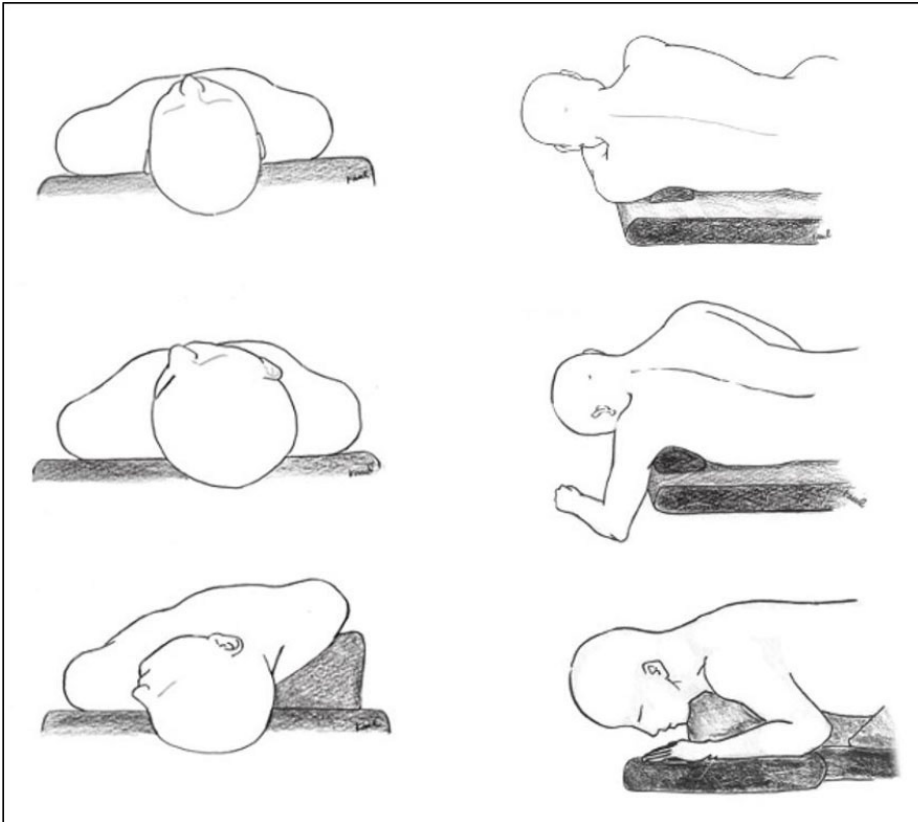
## RESULTS

### Positioning

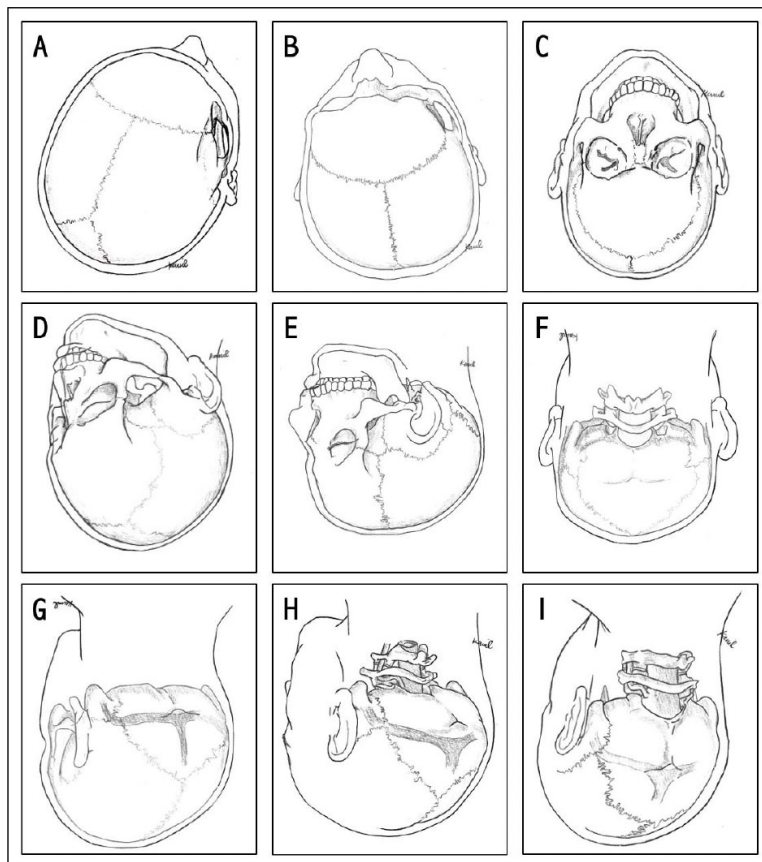
Cranial procedures require careful assessment of patient positioning in conjunction with the planned surgical approach which should be considered during the preoperative evaluation. Proper positioning allows the most direct access to the surgical target and reduces the working distance for the surgeon. Attentive positioning avoids brain retraction except by gravity and minimizes bleeding into the operative field, and also prevents pressure or traction injuries, including skin breakdown, ocular injuries, and peripheral nerve injuries.<sup>1</sup> Proper positioning results in relaxation for the surgeon, the sleeping patient, and the brain. Here are six template illustrations of the major patient positions used in cranial surgery (Fig. 1).

### Surgical approach

In selecting a surgical approach from the majority of cranial surgery procedures, the surgeon should aim to provide the safest, most direct corridor with maximal access to the pathology. This approach must



**Figure 1.** The positioning templates.



**Figure 2.** The template of head positioning.

further minimize morbidity to structures traversed en route to and surrounding the pathologic process of interest. Furthermore, surgical manipulation generally minimizes retraction, traction, and compression of nervous structures.<sup>2</sup> We provide nine illustration templates of the basic head positioning that represents the routine cranial surgical approach (Fig. 2).

### Case illustration

#### Case 1: Anterior cerebral aneurysm clipping with pterional approach

Forty-seven years old female was referred to the emergency department from the district hospital with a chief complaint of seizure 10 days before admission. Before having a seizure, the patient had a thunderclap headache. The patient had a history of hypertension but she did not take any regular medications. Non-contrast head computed tomography (CT) scan showed a left frontal intracerebral lesion with subarachnoid and intraventricular hemorrhage. CT angiography showed a ruptured left A1 aneurysm. We planned to perform emergency clipping of the aneurysm using the left pterional approach (Fig. 3).

#### Case 2: Trigeminal neuralgia with retrosigmoid approach

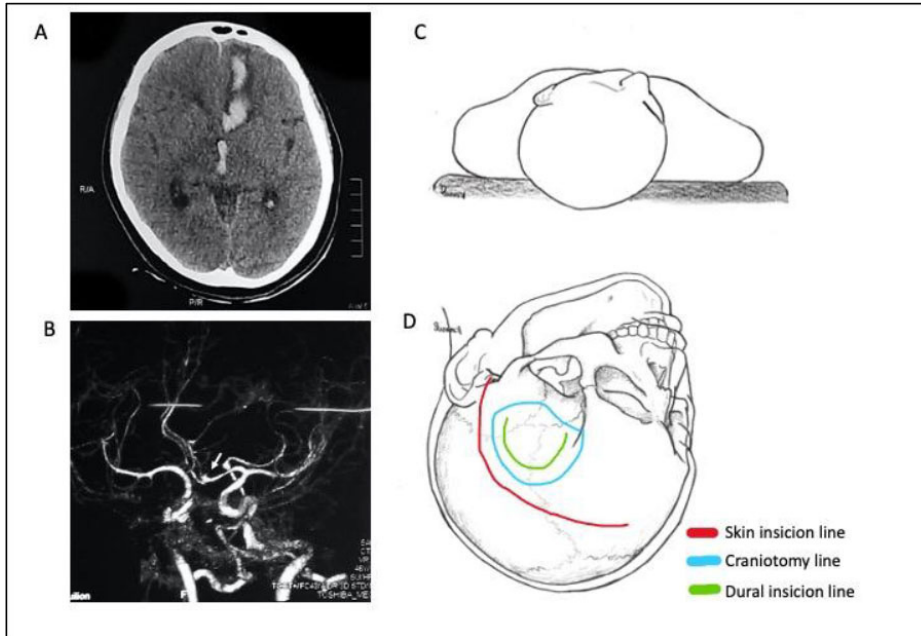
Sixty-nine years old female came to the neurosurgery department with a chief complaint of right facial pain in the last four years. She consumed Gabapentine almost every day without any improvement in the pain. Magnetic resonance imaging showed neurovascular contact of the right superior cerebellar artery with the root of the right trigeminal nerve. We planned to perform microvascular decompression using the right retrosigmoid approach (Fig. 4).

### DISCUSSION

Every neurosurgeon especially those who have just begun their carrier in operation theater should carefully pay attention to small details such as the patient's body and head position with the primary concern beyond intracranial anatomical complexes. In order to communicate surgical planning as an essential part of neurosurgical education, the trainees or resident or even their tutors sometimes

have certain barriers in delivering their knowledge inclusively to discuss each other about surgical approach design. An appropriate illustration might help

in communicating such detail, especially in the positioning and head position. In the neurosurgical field, there was only a view of basic optional approaches for the surgery with many varieties of the incision lines design depending on the surgery goal. Therefore, these illustrations, even simple, could add some value in communicating and presenting the surgical planning to the fellows.



**Figure 3.** First case illustration. A. Axial head computed tomography scan shows a left frontal intracerebral lesion with subarachnoid and intraventricular hemorrhage; B. Computed tomography angiography showed ruptured left A1 aneurysm (arrow); C. Supine position with the tilt to the right about 15 degrees; D. The semi lateral head.

**CONCLUSION**

Neurosurgery will always remain among the most audacious of human endeavors; surgical planning provides the footing to help patients and diminish the burden of neurological disease. Our assumption is that good preoperative planning, including using appropriate positioning and head positioning can step up the quality of the operation itself, especially in the educational and clinical training settings in the current digital era.

**CONFLICT OF INTEREST**

There was no conflict of interest.

**FUNDING**

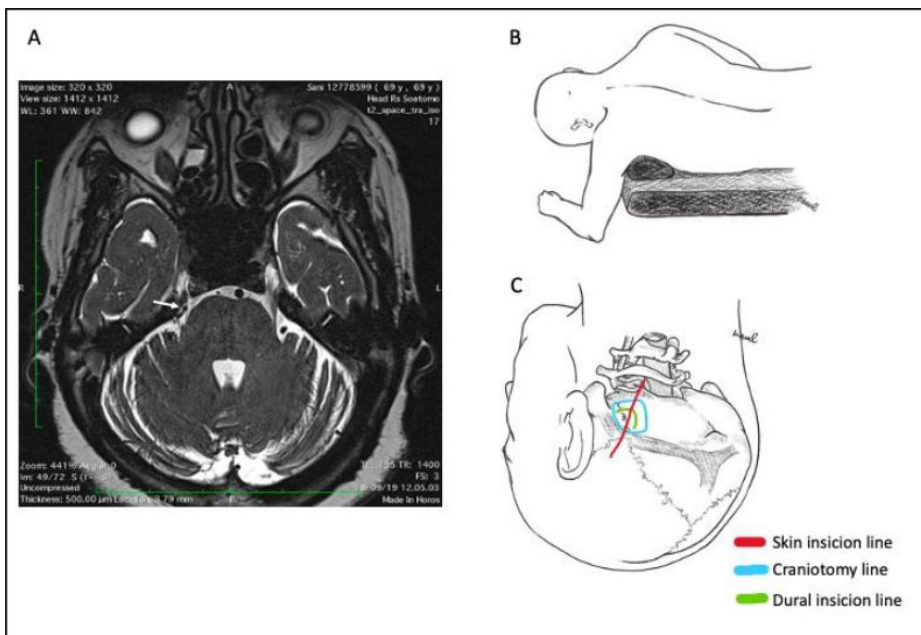
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**AUTHOR CONTRIBUTIONS**

MK: text and illustration; MRA: text.

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**Figure 4.** Second case illustration. A. Axial plan T2WI magnetic resonance imaging showed neurovascular contact of the right superior cerebellar artery with the root of the right trigeminal nerve (arrow); B. Lateral park bench position template was chosen; C. Posterolateral head positioning template, we draw skin incision line (red), craniotomy line (light blue) and dural incision line (light green) to show the pre-operative planning to this case. Arrange using Microsoftä PowerPoint presentation. Magnetic resonance image is the author’s personal collection.



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