

Comparison of tumor surface marking by experienced neurosurgeon versus neuronavigation guidance.

Pankaj Raj Nepal¹, Suman Rijal²

¹Consultant Neurosurgeon and HOD, Department of Neurosurgery, B and C Medical college Teaching Hospital and Research Center, Birtamode, Jhapa, Nepal, ²Associate Professor, Department of Neurosurgery, Nepal Medical College Teaching Hospital, Kathmandu, Nepal

Received: June 15, 2020

Accepted: August 01, 2020

Published: September 01, 2020

Cite this paper:

Nepal PR, Rijal S. Comparison of tumor surface marking by experienced neurosurgeon versus neuronavigation guidance. Journal of Brain and Spine Foundation Nepal. 2020;1(1):2-4.

Correspondence:

Pankaj Raj Nepal

Deputy Medical Director and Head of Department

Department of Neurosurgery

B and C Medical College Teaching Hospital and Research Center, Birtamode, Jhapa, Nepal.

E-mail address: pankajrajnepal@gmail.com

ORCID: <https://orcid.org/0000-0002-0489-7666>

ABSTRACT:

Introduction: Accurate flap marking has always been a challenge for neurosurgeons during tumor surgery. The use of neuronavigation has somewhat overcome this problem by allowing the navigation of intraoperative 3D neuroanatomy of the lesion. In this study, we aim to evaluate the percentage discrepancy of tumor surface marking by experienced neurosurgeon versus neuronavigation guidance. **Methods:** This is a prospective analytical study. Initial surface marking of the tumor was done by experienced neurosurgeon on the basis of sagittal, coronal and axial Magnetic Resonance Imaging films; and later was re-marked using neuronavigation. Photographs of surface markings were taken then comparison was done by plotting marking on the standard graph paper and percentage discrepancies were calculated for every case. **Results:** Percentage discrepancy ranged from 15 % to 81 % and the mean discrepancy score was 44%. **Conclusion:** Even in experienced neurosurgeon's hand, flap marking is not always accurate and neuronavigation definitely seems to be an effective tool.

Key words: Brain neoplasms, Craniotomy, Neuronavigation.

Introduction:

Accurate flap marking has always been a challenge for neurosurgeons during tumor surgery, especially in cases of convexity meningioma, and cortical gliomas. The use of neuronavigation has somewhat overcome this problem by helping in accurate surface marking of these lesions.¹ Many a times, in the literatures the target localizing accuracy of neuronavigation has been calculated and mean value is around <1.5mm.^{2,3} The main objective of this study was to evaluate the percentage discrepancy of tumor surface marking by

experienced neurosurgeon versus neuronavigation guidance.

Methods:

A prospective analytical study was done with an objective to calculate the discrepancy in between surface marking of an operative flap for a brain tumor surgery by an experienced neurosurgeon versus a neuronavigation guidance. A non-probability consecutive sampling was done and 10 cases of brain tumors operated in between January to March 2015

were included in the study Initial surface marking of the tumor was done by our experienced neurosurgeon on the basis of sagittal, coronal and axial Magnetic Resonance Imaging (MRI) films; and later was re-marked using neuronavigation (Medtronic Stealth Station S7 neuronavigation system). Photographs of the surface markings (Figure 1) were taken and were later printed in a paper (Figure 2). The margins of both the surface markings were then carbon-copied on a standard graph paper (Figure 3). Area inside the neuronavigation guidance marked plot but not intersected by the experienced neurosurgeon's marking were labeled as "a" and the total area under the neuronavigation guidance marked was labeled as "A". Percentage discrepancy of the markings by experienced neurosurgeon was calculated by following formula.

$$\text{Percentage discrepancy} = \frac{a}{A} \times 100\%$$

Percentage discrepancies of each cases were calculated and mean percentage discrepancy was derived and charted in an EXCEL chart.



Figure 1: Photograph of surface markings. Green marking is initial surface marking by experienced neurosurgeon and the red marking done by neuronavigation guidance.

Results:

There were total 10 cases included in this study of which seven were males and three were females. The

mean age of the patients was 55.60 ±10.09 years. All of the cases were of either convexity lesion or cortical lesions. The mean percentage discrepancy in between experienced neurosurgeon's marking of the flap and neuronavigation guided marking was 44%±20.42% (15-81%) (Table 1).

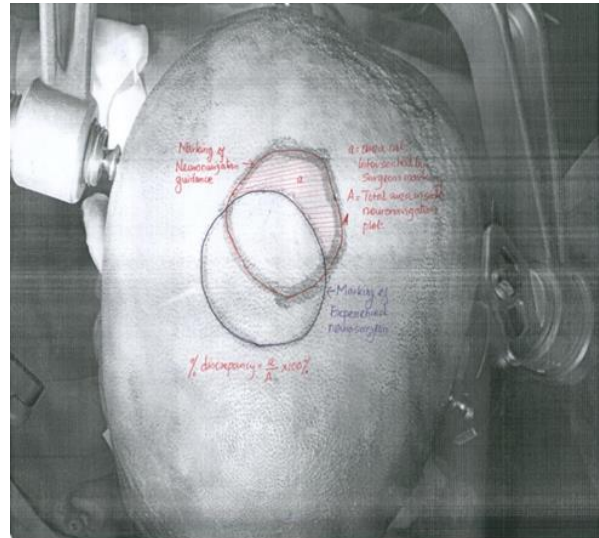


Figure 2: Printed photograph, with labeled margins.

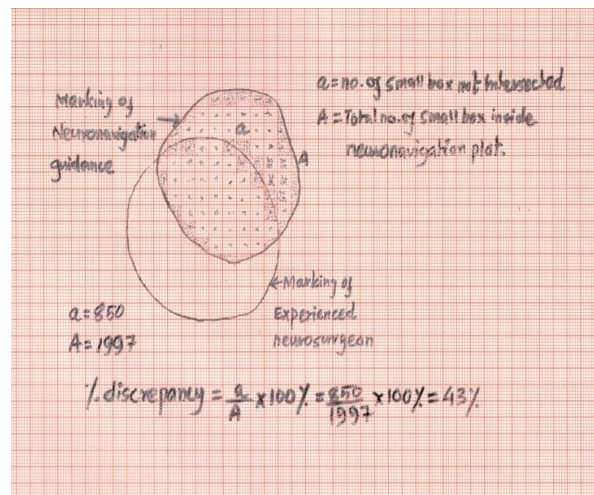


Figure 3: Plotting markings on the standard graph paper with % discrepancies calculated.

Discussion:

An experienced neurosurgeon with decades of experience operating on brain tumors, without any doubt are the best ones for accurate flap marking. But,

when it comes to be the small convexity cortical tumors; then taking measurements from the scans, and marking them may not be always satisfactory. In our study, we found the experienced neurosurgeon has as low as 15% to as high as 81% discrepancy while comparing with the markings made with the aid of neuronavigation guidance. Neuronavigation is supposed to be the accurate tool in initial surface marking, with target localizing accuracy of <1.5mm to 2mm.²⁻⁴ There are issues of silent loss of neuronavigation accuracy, like 2.7mm loss of accuracy after draping, 1.2mm loss after skin retractor attachments, further 1mm loss after craniotomy and so on.⁵ However, as this study was performed by drawing both the surface markings after keeping the patient in three pin head rest before draping the issue of silent loss of neuronavigation accuracy while calculating percentage discrepancy was avoided.

Conclusion:

Even by an experienced neurosurgeon, free-hand flap marking is not always accurate and neuronavigation definitely seems to be an effective tool.

Acknowledgement: We are very thankful to Late. Prof. Upendra P Devkota for encouraging us and helping us

by making the initial tumor surface marking performed in this study.

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Table 1: Mean and standard deviation of percentage discrepancies.

	N	Minimum	Maximum	Mean	Standard deviation
Percentage discrepancies	10	15%	81%	44%	20.42%