

The Prevalence of Protrusion of Infraorbital Nerve into Maxillary Sinus identified on CT Scan of the Paranasal Sinuses at a Tertiary Hospital in Nepal

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ABSTRACT

Introduction: The variation in the course of infraorbital canal and protrusion of the infraorbital nerve through it to the maxillary sinus may lead to its accidental injury during reconstructive or endoscopic sinus surgery. Preoperative identification of this variant will prevent unintended injuries.

Methods: A retrospective study of 307 patients who underwent CT scan study of the paranasal sinuses at Chitwan Medical College, Nepal was conducted. The protrusion of infraorbital nerve to the maxillary sinus was identified and the length of the bony septum along with the infraorbital nerve was measured. It was further classified as Class I to III according to the length of the septum.

Results: The prevalence of protrusion of inferior orbital nerve in our study was 11.40 % and bilateral protrusion was 5.8 %. The median length of the protruding component along with the septum was 4.9 mm.

Conclusion: Preoperative identification of the normal protrusion of infraorbital nerve to the maxillary sinus will prevent accidental injuries during sinus surgery. CT scan of the paranasal sinus would be the modality of choice for identification of this variant.

Key words: *Computed Tomography; Infraorbital Canal; Infraorbital Nerve*

INTRODUCTION

Plain x-ray as an imaging modality for evaluation of the paranasal sinuses has been almost completely replaced with computed tomography. CT scan is the diagnostic modality of choice for evaluation of the paranasal sinuses following accidents and for pre-operative evaluation of sinus inflammatory

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disease or any tumoral lesion of the paranasal sinuses¹. CT scan not only provides adequate information regarding the disease process but also identifies normal variants in relation to the paranasal sinuses.² Identification of these normal variants is utmost important to reduce accidental surgical injuries.

The infraorbital nerve is terminal branch of maxillary nerve which in turn is the second branch (V2) of the trigeminal nerve. It leaves the pterygopalatine fossa to enter the orbit through the inferior orbital fissure. The nerve courses along the floor of the orbit through the infraorbital canal and exits normally from the infraorbital foramen of the maxillary bone along with the inferior orbital vein and artery.^{3,4} Variation in the course may result in protrusion of infraorbital nerve from the infraorbital foramen to the maxillary sinus.^{5,6} This protrusion of the infraorbital nerve renders it prone to accidental injury during maxillary sinus surgery. There are no published studies till date to identify the prevalence of this anatomical variation among Nepali population. This study aims to identify the prevalence of this normal anatomical variation.

METHODS

Three hundred CT scan of the paranasal sinuses were retrospectively selected and images were reviewed by two consultant radiologists with five years of experience in reporting CT scan images. All the CT scan was performed in a 16 slice multidetector CT scan machine (GE bright speed) at the Department of Radiology of Chitwan Medical College, Nepal from January 2017 to July 2017. The axial images were acquired at 3 mm with reconstruction at 0.625 mm thickness. Images were acquired with bone and soft tissue algorithm. Coronal and sagittal reformation was done. The patients with trauma involving the orbital floor were excluded from the study. The presence or absence of protrusion of infraorbital nerve to the maxillary sinus was noted. Protrusion was confirmed with entire circumference of the

infraorbital canal along with the infraorbital nerve was noted within the maxillary sinus without touching the walls.¹ The length of the protruding component along with the bony septum was measured on axial images. The variation whether bilateral or unilateral was also noted.

RESULTS

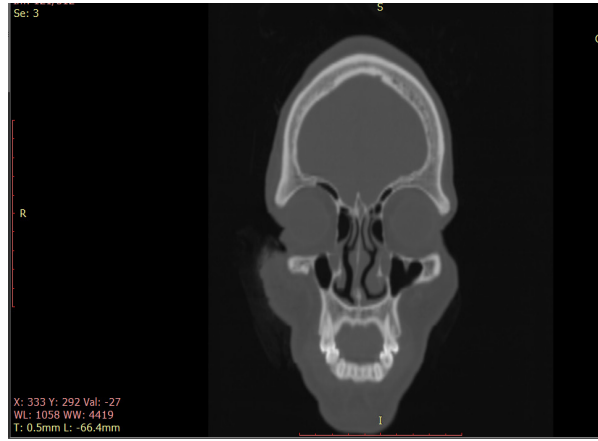
Total 307 CT scan of the paranasal sinuses were reviewed for the study and out of which 201 were males and 106 were females. The median age of the patient was years 50 (range, 10 to 90 years). The prevalence of protrusion of infraorbital nerve to the maxillary sinus was noted in 35 patients with prevalence of 11.4%. Bilateral protrusion was noted in 18 patients with prevalence of 5.6 %. The length of the protruding component was noted ranging from 0.9 mm to 8.9 mm with median length of 4.9 mm. Class I protrusion (1-3 mm) was noted in 15 patients (42%), Class II (4-6 mm) in 17 patients (48%) and class III (7-11 mm) in 3 patients (8.5 %). The representative images are demonstrated at Figure No. 1, 2, 3 and 4. Similarly the tabulated data are described at Table No. 1 and 2.

DISCUSSION

Three hundred 307 CT scans of the paranasal sinuses were reviewed. The prevalence of protrusion of infraorbital nerve to the maxillary sinus was found to be 11.4 %. The protrusion was defined when entire circumference of the inferior orbital nerve was noted within the maxillary sinus without touching the walls.¹ The protrusion was always accompanied with a bony septum. The length of the protruding component along with the bony septum was noted. They were classified as class I (1-3 mm), II (4-6 mm) and III (7-11 mm) according to their length. Different classification system has been proposed for this variant.^{1, 4, 7} The definition and classification system for our study was adopted from the paper published by Lantos et al.¹ Acgar et al in their study



1. (a)



1. (b)

Fig 1 (a) and (b): Axial and coronal CT scan images of the paranasal sinuses demonstrating Type I protrusion (white arrow) of the left infraorbital nerve at the left maxillary sinus. The protrusion measured 3mm.

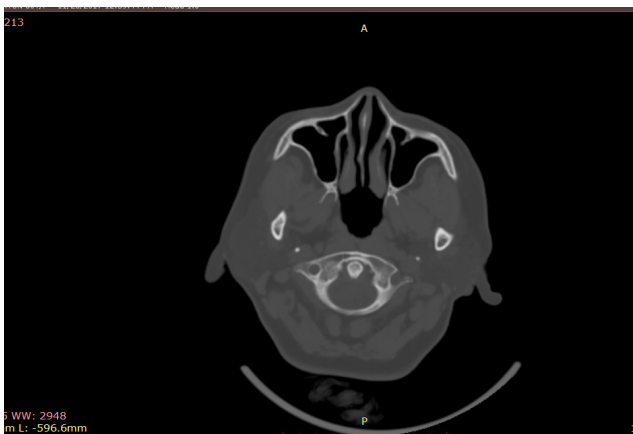


2. (a)



2. (b)

Fig 2a and b: Axial and sagittal CT scan images of the paranasal sinuses demonstrating Type I protrusion (white arrow in fig a and b) of the right infraorbital nerve at the right maxillary sinus. The protrusion measured 2.6mm.



3. (a)



3. (b)

Fig 3a: Axial CT scan images of the paranasal sinuses demonstrating Type III protrusion of bilateral infraorbital nerve (white arrow) at the maxillary sinuses. The protrusion measured 8 mm. **Fig 3b:** Protrusion demonstrated on right sagittal image (white arrow).

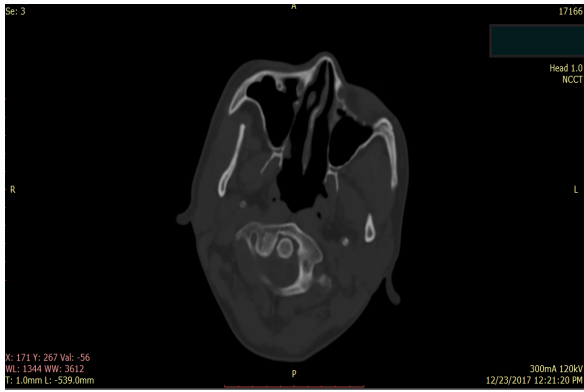


Fig 4: Axial CT scan images of the paranasal sinuses demonstrating Type II protrusion of the right infraorbital nerve (white arrow) at the right maxillary sinus. The protrusion measured 4mm.

classified this variant into four subtypes as Type 1: within the maxillary bony roof, Type 2: partially protruding into maxillary sinus, Type 3: within the maxillary sinus, Type 4: located anatomically at the outer limit of the zygomatic recess of the maxillary bone.⁴ The definition by Lantos et al has specific measurements for classification and easy to follow.

Numerous variants of the paranasal sinuses are identified on CT scan of the paranasal sinuses. Earwaker in his study classified them into two categories as variant related to bone abnormality and other as sinus air cells extension.² The commoner variants were related to nasal septum and middle turbinate. Similar results were noted by Karki et al on the study to identify the variants of paranasal sinuses among Nepali population.⁸ On reviewing the literature there are only few studies published related to identifying the protrusion of inferior orbital nerve to maxillary sinus and no published study as

such was found from Nepal. This study is primarily aimed to find the prevalence of it among Nepali population.

The inferior orbital nerve lies within the inferior orbital canal, a thin rim of bone coursing along the orbital floor. The main nerve to the maxillary sinus is from the maxillary nerve via infraorbital and anterior, middle, and posterior superior alveolar nerves.^{9, 10} Orbital blow out fracture is the commonest orbital fracture and involves the orbital floor.¹¹ There is high likelihood of fracture involving the inferior orbital canal and resultant injury to the inferior orbital nerve. This results in paresthesia of the face and lips. The protrusion of inferior orbital nerve to the maxillary sinus is a variant in the course of nerve. Similar to the prior studies on the literature this protrusion was invariably associated with a septum in our study. This variation in the course makes the nerve vulnerable to iatrogenic injury during surgeries of the paranasal sinuses or surgery of the maxillo-facial skeleton. The surgeries with high probability of iatrogenic injuries if not identified preoperatively are functional endoscopic sinus surgery (FESS) for maxillary sinus inflammatory disease, orbital reconstructive surgery and Caldwell-Luc operation among many others.¹² Preoperative identification of this variant provides a good road map for the surgeons to prevent accidental injuries.¹³

The prevalence of this variant was found to be 11.6 % and the median length of the protrusion with accompanying septum was 4.9 mm in our study where as in the study by Lantos et al it was noted to be present in 10.8 % and the average length of the septum was 4 mm.

Table 1: Characteristics of patients

Total number of patients	Protrusion present	Unilateral protrusion	Bilateral protrusion
307 201 males: 65% 106 females: 35 %	35 (11.6%)	17 (5.5%)	18 (5.6 %)

Table 2: Classification of the septum according to the length

Type	No. of patients
1 (1-3 mm)	15 (42%)
2 (4-6 mm)	17 (48%)
2 (7-11 mm)	3 (8.5%)

CONCLUSION

On reviewing the literature no study as such from Nepal was found identifying the prevalence of protrusion of infraorbital nerve to the maxillary sinus among Nepali population. The identification of this variant and length of the protrusion should be mentioned in the radiology report for prevention of accidental iatrogenic injury to the infraorbital nerve.

CONFLICT OF INTEREST

None

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None

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