

Ultrasonographic Assessment of Submandibular Salivary Gland at a Tertiary Care Centre in Nepal

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ABSTRACT

Background: Various disease conditions can lead to the increased size of the submandibular gland. Normal dimensions of the salivary gland are useful for the identification and diagnosis of various associated pathology. The study objective was to assess the normal dimension of the submandibular gland using an ultrasonograph at a tertiary care centre in Nepal.

Methods: The descriptive cross-sectional study was conducted in the Department of Radiology and Imaging College of Medical Sciences, Bharatpur, Nepal among 126 patients. Ultrasound of the submandibular gland was done of all patients with Toshiba Aplio 500 superficial probe. The data were collected and entered into Statistical Package for the Social Sciences version 16 and analyzed using descriptive statistics. Later the data was presented in form of tables.

Results: There were in total 126 patients who participated in the study. Among them 78 (61.9%) were females and the rest were males. The mediolateral width of the right submandibular salivary gland (2.70 ± 0.40 cms) was slightly greater than the left side. The volume of the left salivary gland (6.91 ± 2.32 cm³) was slightly larger than the right side in males. However, there was no statistically significant difference between male and female

Conclusion: This study concluded that the volume of the left salivary gland was slightly larger than the right side. The volume of the salivary gland of females was more than males.

Keywords: Submandibular gland, Salivary gland, Ultrasonography.

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INTRODUCTION

The submandibular gland is the second largest major salivary gland situated in the submandibular triangle.¹ Various pathological processes can occur in the submandibular gland causing alteration in the size of the submandibular gland. Many inflammatory diseases caused by viruses and bacteria cause enlargement of the

submandibular gland.² Uzun et al reported the size and volume of the submandibular gland were less after chorda tympani surgery.³

Diseases such as diabetes, hypertension and other factors related to diet and habits such as smoking and alcohol consumption have also been reported to affect the size and function of the salivary gland.⁴ On

the other hand aging also affects the submandibular gland causing atrophy and fibrosis of the salivary gland.⁴

Many diagnostic methods have been employed to study the salivary gland including ultrasound, magnetic resonance imaging, and computed tomography.⁵ All methods have their advantages and disadvantages. Among the different modalities, ultrasound is highly used. Ultrasound is easily available and comparatively low cost with no ionization radiation hazards making it an invaluable modality for salivary gland imaging.^{2, 5-7}

Studies related to normal ultrasonographic biometry of salivary gland is very scarce. Such study has not been conducted in Nepal. Hence this study aimed to assess the normal dimension of submandibular gland using ultrasonograph at a tertiary care centre of Nepal.

METHODOLOGY

This descriptive cross-sectional study was carried out in the Department of Radiology and Imaging of College of Medical Sciences, Bharatpur, Chitwan. This study was performed over a period of three months from March, 2021 to May 2021 in accordance with the local ethics committee (COMSTH-IRC/2021-50). All the patients were informed about the study objectives and informed consent was taken. A convenience sampling method was used.

Patients of both genders, who gave agreed and consent to participate in the study were included in the study. Patients with submandibular gland enlargement such as ranula, tumor, Ludwig's angina, space infections were excluded. Pregnant and lactating mothers, patients under medications that can influence the salivary gland secretions and with history of chemotherapy of head and neck were also excluded.

The dimension of submandibular glands was measured by using Aplio 500 Toshiba Machine with of frequency 7-10MHZ. For the ultrasound examination the neck of the patient was extended by keeping a pillow under the patient's shoulder. The head was turned away from the side to be examined. Two planes' images of submandibular glands, longitudinal and transverse, were taken for measurement. The maximum length in anteroposterior and mediolateral dimension and the paramandibular depth of gland was measured as described by Onkar et al.² The measurements of both

glands were taken separately and evaluated. The volume of the gland was determined using formula:

Volume= anteroposterior length $\times$ mediolateral width $\times$ paramandibular depth $\times$ 0.52⁸

All data was taken by single operator experienced in USG. The data was collected and entered into Statistical Package for the Social Sciences (SPSS) version 16 (SPSS, Inc., an IBM Company, Chicago, IL). The data was presented in form of frequency, percentage, mean $\pm$ SD and independent t-test. Further independent t-test was used to analyze the data. A p-value of less than 0.05 was considered as statistically significant.

RESULTS:

Present study was conducted in the 126 patients. The mean age of the participants was 30.74 $\pm$ 10.44 years. Among the participants there were 78 (61.9%) females and 48 (38.1%) males (Table 1).

Characteristics of participants		Frequency (%)
Gender	Male	48 (38.1)
	Female	78 (61.9)
Race	Khas	56(44.4)
	Adiwasi Janajati	44(34.9)
	Newar	16(12.8)
	Madhesi	10(7.9)
Age group	Above 40	104(82.5)
	Below 40	22(17.5)
Mean Age (years) $\pm$ SD		30.74 $\pm$ 10.44

Table 2 showed the anthropometric data on basis of race. The anteroposterior length of submandibular gland was more among the Adiwasi Janajati on either side. The mediolateral width was large among Khas group. The volume of submandibular gland was also more among the Khas group (6.62 $\pm$ 2.85 cm³ on the right side and 6.66 $\pm$ 2.30 cm³ on the left side).

The mediolateral width of right submandibular salivary gland (2.70 $\pm$ 0.40 cm) was slightly greater than the left side. The paramandibular depth of the left submandibular gland was greater among both male and female. The volume of left salivary gland (6.91 $\pm$ 2.32 cm³) was slightly larger than the right side in male. However, there was no statistically significant difference between male and female (Table 3).

Table 4 showed the association of the dimensions of right and left submandibular gland with age group below and above age 40 years. No statistically significant difference was identified within the age groups.

Table 2: Anthropometric parameters of submandibular gland on basis of race

Variables	Khas		Adiwasi Janajati		Newar		Madhesi	
	Right	Left	Right	Left	Right	Left	Right	Left
Anteroposterior length (cm)	3.19±0.33	3.22±0.38	3.24±0.29	3.29±0.30	3.20±0.32	3.18±0.29	3.22±0.38	3.23±0.55
Mediolateral width (cm)	2.74±0.46	2.63±0.35	2.69±0.35	2.62±0.36	2.64±0.33	2.51±0.28	2.57±0.42	2.42±0.53
Paramandibular depth (cm)	1.43±0.27	1.49±0.30	1.43±0.24	1.46±0.22	1.33±0.23	1.44±0.21	1.54±0.15	1.46±0.27
Volume (cm ³)	6.62±2.85	6.66±2.30	6.60±1.88	6.61±1.70	5.92±1.69	6.06±1.57	6.61±1.59	6.25±3.04

Table 3: Association of anthropometric parameters of submandibular gland with gender

Variables		Male (Mean±SD)	Female (Mean±SD)	Total (Mean±SD)	p-value
Right Submandibular Gland	Anteroposterior length (cm)	3.26±0.39	3.18±0.26	3.21±0.31	0.221
	Mediolateral width (cm)	2.7±0.43	2.70±0.40	2.70±0.40	0.982
	Paramandibular depth (cm)	1.43±0.24	1.42±0.26	1.43±0.25	0.857
	Volume (cm ³)	6.64±2.12	6.44±1.98	6.52±2.02	0.593
Left Submandibular Gland	Anteroposterior length (cm)	3.31±0.42	3.19±0.31	3.24±0.36	0.098
	Mediolateral width (cm)	2.63±0.40	2.57±0.34	2.59±0.37	0.377
	Paramandibular depth (cm)	1.50±0.29	1.45±0.23	1.47±0.26	0.352
	Volume (cm ³)	6.91±2.32	6.30±1.91	6.53±2.08	0.109

Table 4: Association of anthropometric parameters of submandibular gland with age group

Variables		Above 40 (Mean±SD)	Below 40 (Mean±SD)	p-value
Right Submandibular Gland	Anteroposterior length (cm)	3.20±0.30	3.26±0.39	0.438
	Mediolateral width (cm)	2.70±0.42	2.68±0.37	0.794
	Paramandibular depth (cm)	1.44±0.26	1.38±0.22	0.344
	Volume (cm ³)	6.56±2.08	6.32±1.77	0.614
Left Submandibular Gland	Anteroposterior length (cm)	3.22±0.37	3.34±0.32	0.163
	Mediolateral width (cm)	2.60±0.36	2.56±0.38	0.628
	Paramandibular depth (cm)	1.48±0.25	1.43±0.31	0.437
	Volume (cm ³)	6.55±2.07	6.46±2.21	0.852

DISCUSSION

The submandibular gland is a paired, major salivary gland with the shape close to a triangle in a longitudinal and transverse section.^{2,9} Many diseases and inflammation of the gland and other factors affect the size of the submandibular gland.^{8, 10} The dimensions of major salivary are affected by ageing and obesity as well.¹¹ Manetti et al reported the increase in volume of submandibular gland in patients suffering from acromegaly.⁸ Even the overall size of submandibular gland was changed in patients undergoing radiotherapy.¹²

Among the different methods used, ultrasound method was employed in this study for the assessment of salivary gland in any pathology.¹³⁻¹⁵ However, only few studies have been conducted related to the dimensions of submandibular gland.^{2, 3, 10} In 1984, Barlett LJ and Pon M reported the measurement of submandibular gland using high resolution real time ultrasound.¹⁶ The major salivary gland (parotid and submandibular gland) when visualized in ultrasound, appear homogenous and hyperechoic.¹⁷ However, when compared among the parotid and submandibular glands, the submandibular glands are hypoechoic than the parotid gland.^{18, 19} The measurement of echogenicity was not the objective in this study. The present study was conducted to provide reference data related to dimensions of submandibular gland in Nepalese population in Chitwan.

In the present study, the measurement of right and left submandibular gland were reported separately. Few studies have reported the altogether mean value of the submandibular gland.^{2, 3, 10, 20} Dost P and Kaiser S conducted the size assessment of submandibular and parotid gland by ultrasonography among 25 male and 25 female. They reported mean anteroposterior length as 35.6 ± 5.7 mm, the paramandibular depth as 14.3 ± 5.7 mm and the width as 33.7 ± 0.54 mm.^{10, 20} These findings were higher than the present study. In contrast to our

study, the study conducted in India by Uzun et al reported the dimension slightly close to present findings.³ In another study Onkar et al reported slight variation in the measurement of mean paramandibular depth (mean 1.74 ± 0.27 cm)² which was higher than the present study. The width was lesser than the present study.² The variation may be due to the geographical condition, diet, sample size of the study.

The measurement of volume of submandibular gland was also done in this study. Among the right and left submandibular gland, the volume of left gland was slightly more than the right side. Again, when compared with the gender, the volume of submandibular gland of both right and left side was more in male than in females. However, these measurements were in sharp contrast with that reported by Dost et al.¹⁰, Uzun et al.³ and Onkar et al.² The volume of submandibular gland was more than that reported by Dost et al (3.0 ± 1.4 ml in females and 3.9 ± 1.4 ml in males).¹⁰ However the volume was more in the study reported by Uzun et al and Onkar et al.^{2, 3} The variation on the volume may also be depicted with the use of formula to calculate the volume. In the present study, ellipsoid method was used.⁸ Onkar et al. also used ellipsoid method.² Dost et al have used Simpson's method to calculate the volume.¹⁰

The study also has limitations. The study was conducted in small sample size and the convenience method of sampling was used. The study mainly focused on the patients coming to a tertiary care center so the results obtained cannot be generalized to the whole nation.

CONCLUSION

In conclusion present study provides the range of submandibular salivary gland on the basis of sides, age group, race and gender. This study concluded that the volume of left salivary gland was slightly larger than the right side. The volume of salivary gland of females was more than male.

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