A study of the pterygopalatine fossa and it's ganglion in a South African skeletal and cadaver population

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Introduction

Trigeminal neuralgia is a disease related to the fifth cranial nerve[1,2,3]. It is the most common cause of orofacial pain. Symptoms of this disease include episodes of extreme pain in the distribution areas of one or more of the trigeminal divisions[3]. Minor activities such as facial movement, talking, cold temperatures or even a small breeze across the face can trigger a trigeminal neuralgia attack[2]. Treatments are aimed at pain relief and consist of a wide range of options, including pharmaceutical and surgical interventions. A review of the literature illustrates that deposition of anaesthetic fluid in the vicinity of the pterygopalatine ganglion effectively alleviates the symptoms of trigeminal neuralgia[4]. There are various approaches described in the literature for performing what has been referred to as a pterygopalatine block. None of the described techniques are specific, nor do they provide anatomical landmarks as a guide to performing the block[4]. Although reported to be highly effective in the relief of pain, the pterygopalatine block is not commonly used[4]. The lack of use of this highly effective technique is attributed to the vague descriptions of the techniques that make the procedure difficult to perform by untrained professionals. Therapeutic effectiveness has been claimed in various cases, including: facial pain, neck pain, cluster headaches, lower back pain, hyperthyroidism and menstrual pain[5].

Aim

To study the pterygopalatine fossa and devise a safe and alternative method of locating the fossa, including its contents, without the aid of radiography.

Materials and Methods

A total of 160 adult human skulls (40 black males, 40 black females, 40 white males, 40 white females) from the Department of Anatomy, University of Pretoria were selected. Three measurements, namely A, B and C (Figure 1) were taken on the lateral aspect of the skulls. Landmarks for these measurements are seen in Figure 1. A multiple regression analysis was carried out using these measurements and population affinity. The coefficients and constants obtained were put into a regression formula. Measurement B was an indicator in predicting the location of the pterygopalatine fossa (PPF). Thus, no coefficient was obtained for B. The population affinity was assigned as zero for whites and one for blacks. The depth of the PPF from the zygomatic arch was determined by placing a calibrated lumbar puncture needle into the PPF and the distance from the zygomatic arch to the tip of the needle was then measured. The angle at which the PPF is located inferior to the zygomatic arch was measured with a protractor using the zygomatic arch as a guide.
The formula was tested on the left and right sides of 47 cadavers by substituting the values for measurements A and C as well as population affinity into the regression formula which produced a predicted measurement B.

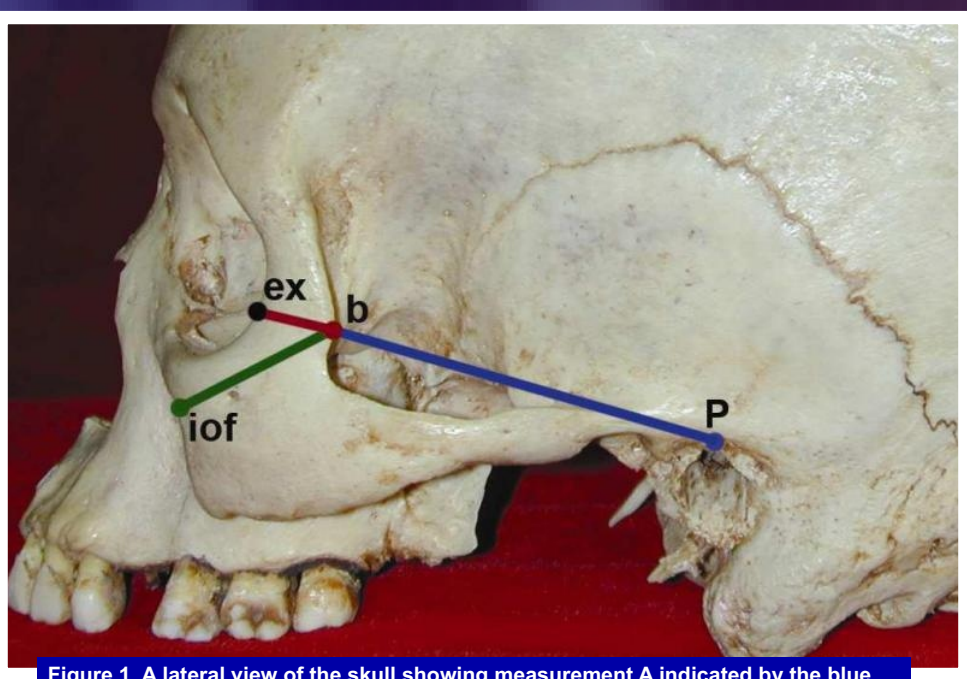


Figure 1. A lateral view of the skull showing measurement A indicated by the blue and red lines combined (exocantion to Porion), measurement B indicated by the red line (exocantion to calculated landmark b) and measurement C indicated by the green line (infra-orbital foramen to calculated landmark b)

Results

Table 1. Regression coefficients for the various variables (Measurement A, measurement C, population) measured on the left and right pterygopalatine fossa (PPF). The coefficients were obtained from the skull and the dimensions are those of the cadavers

	Measurement A		Measurement C		Population		
	Coefficient	Dimension (mm)	Coefficient	Dimension (mm)	Coefficient	Affinity	Constant
Right PPF	0.1014403	80.13	0.3616089	43.54	1.201275	0	-8.1076
Left PPF	0.1040883	79.09	0.3675193	48.62	1.267808	0	-8.4207

Results from the regression analysis are shown in Table 1. Measurement A on the right PPF was slightly greater than the left PPF. Measurement C on the other hand, was greater on the left PPF than on the right PPF. However, none of these differences were statistically significant. The values from Table 1 were inserted into a formula to predict measurement B (ex-b as seen on Figure 1).

Example:
Measurement B (predicted) = (coefficient A multiplied by measurement A) + (coefficient C multiplied by measurement C) + (coefficient population multiplied by population affinity) + constant

Measurement B (predicted)= (0.1040883 x 79.09) + (1.267808 x 0) + (0.3675193 x 48.62) + (- 8.4207) =17.68

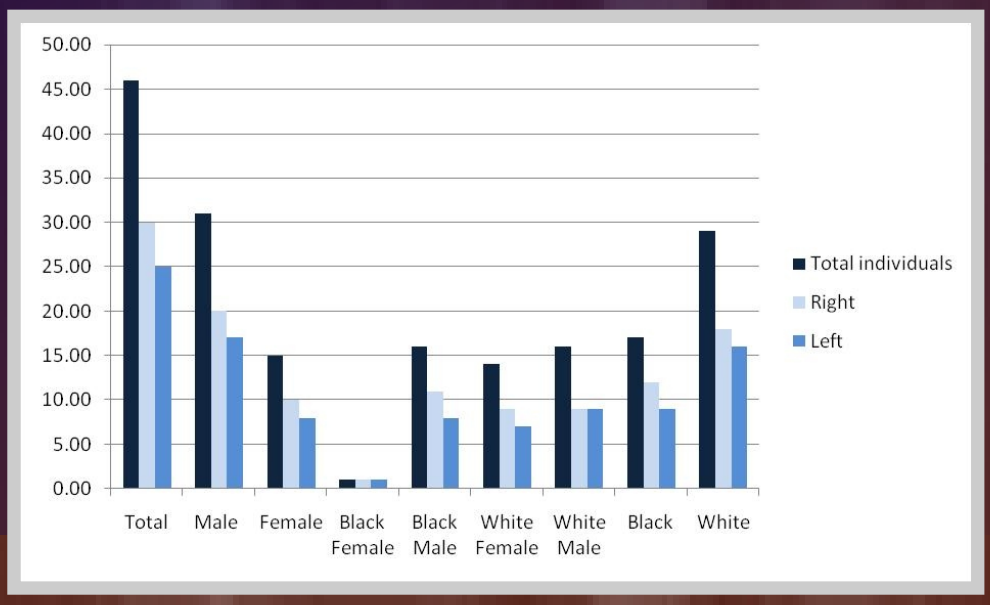
This means that the location of the PPF on the left side is 17.68mm from the exocanthion. The predicted value for the right PPF using the same calculation is 15.77 mm. Interobserver analysis indicated an accuracy of between 85% and 95%. The angle (Table 2) at which the needle was placed into the right PPF ranged from 19.0°-22.0° and for the left PPF it was 18.8°-20.5°. The depth (Table 2) of penetration ranged from 43.4-46.7mm on the right and 44.1-46.9mm on the left.

The measurements used to devise the formulae had a significant influence on the location of the PPF and regression analysis depicted p=0 for measurement C and population affinity and p=0.024 for left and p=0.015 for right for measurement A. The accuracy of predicting the location of the PPF with regression analysis was 46.3% on the left and 51.3% on the right. The accuracies using the cadaver sample increased to 54.4% on the left and 63.0% on the right. Figure 2 shows the accuracy of the number of times the fossa was entered with the needle against the total amount of individuals.

Table 2: Angle (degrees) and depth (mm) for the right and left pterygopalatine fossa recorded in a South African sample

	Angle		Depth	
	Right	Left	Right	Left
black female	19.24	20.49	44.97	44.34
black male	19.06	19.73	46.66	46.96
white female	22.03	20.03	43.39	44.11
white male	19.50	18.78	46.53	46.95

Figure 2. A graphic representation of the accuracy (%) of the number of times the fossa was entered with a needle



Discussion

In 2001,Singh and co-workers reported accuracies of 65% in their study. This compared favourably to the present study especially where the needle was inserted into the PPF, while Singh and co-workers administered anaesthesia close to the pterygomaxillary fissure. No significant differences between the angle and depth measurements on the left and right sides were noted in the present study. A review of the literature indicates that no studies on depth and angle of the PPF have been done and thus a comparison could not be made. The PPF block is not widely used and the three introral and three extraoral techniques that are described in the literature, have vague discriptions on the methods.

Conclusion

This study proposes an alternative method of approach in locating the pterygopalatine fossa and its contents. The method described should be easy to apply and shows that anatomical landmarks can be used to define the location of the PPF. This method could assist clinicians in the treatment of facial pain syndromes including trigeminal neuralgia.

References

1. Pannullo SC, Lavyne MH. Trigeminal neuralgia: neurosurgical management options. JADA 1996; 127: 1635-1639.
2. Turp JC, Gobetti JP, Arbor A. Trigeminal neuralgia versus atypical facial pain. A review of the literature and case report.Oral Surg Oral Med Oral Pathol Oral Radiol Endod,1996; 81, 424-32.
3. Detzel JE, Grelle AR. Trigeminal neuralgia, new treatment options for a well-known cause of facial pain. ARCH FAM MED 1999; 8: 264-268.
4. Vargese BT, Koshy RC. Endoscoptic transnasal neurolytic sphenopalatine ganglion block for head and neck cancer. The journal of laryngology and otology 2001; 115: 385-387.
5. Singh B, Srivastava SK, Dang R. Anatomical considerations in relation to the maxillary nerve block. Regional aneasthesia pain med 2001; 26: 502-511.