Trans-palatal Greater Palatine Injection: Radioanatomic analysis of where to bend the needle for pediatric sinus surgery

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**ABSTRACT**

Objective: The greater palatine canal (GPC) local injection is used to limit posterior bleeding during sinus surgery in adults. Given the potential for causing iatrogenic damage to the intra-orbital contents, this procedure is not commonly utilized in the pediatric population. No studies have described the anatomic development of the GPC during facial growth. By using age-stratified radioanatomic analysis, the dimensions of the greater palatine canal and the clinical implications are described for pediatric patients.

Study Design: Age-stratified radioanatomic study

Methods: High-resolution CT measurements included the thickness of the mucosal plane overlying the GPC, the length of the GPC, and the distance between the base of the pterygopalatine fossa and the orbital floor. Mean distance and standard deviation were calculated for each age cohort and compared using the one-way analysis of variance (ANOVA) test.

Results: The GPC length correlated directly with patient age. It varied from 9.14mm±0.11 in the youngest age group (<2 years) to 19.36±2.76 in adults (18-64 years). The height of the orbit relative to the hard palate approximated the adult dimensions described in the literature by 12-13 years (49.59±1.72).

Conclusion: These radioanatomic results suggest that the GPC injection described for adult patients may be safely administered to selected pediatric patients. For patients >12 yrs, we recommend bending the needle 45 degrees and inserting 2.5mm. For patients 6 to 12 yrs, the needle should be inserted 20mm to enter the PPF. In patients <6 yrs, the needle may safely be placed 12mm into the GPC. Each of these descriptions is based on the minimal distance required to effectively access the PPF, with maximal safety with regard to the orbit. There remains a need for clinical correlation of these findings through future investigation.

**INTRODUCTION**

Injection of the greater palatine canal has been well-described in adults for the purposes of controlling posterior nasal hemorrhage, anesthetizing branches of the maxillary division of the trigeminal nerve traversing the pterygopalatine fossa (PPF), and relief of sphenopalatine neuralgia. Accepted indications include prophylactic infiltration for endoscopic sinus surgery and septorhinoplasty, management of refractory epistaxis, and regional blocks for dental procedures. Because of the direct communication of the PPF with the infraorbital fissure, and the close relationship of these structures to the greater palatine foramen (GPF), this injection carries a significant risk of complications. These may include: intravascular injection with associated cardiovascular side effects, blindness due to vasoconstriction of the ophthalmic artery, infraorbital nerve injury, PPF and/or infra-temporal fossa abscesses and meningitis. These risks, and an incomplete understanding of the anatomic changes that occur in this region during development, have limited the use of this procedure in pediatric patients. Anatomic elucidation of a safe method for delivering the greater palatine injection in pediatric patients thus constitutes an addition to the armamentarium in the treatment of dental and sinonasal conditions in children.

**METHODS AND MATERIALS**

We reviewed the maxillofacial CT scans of 50 pediatric and 10 adult patients. The pediatric cohort was comprised of individuals <18 years of age who had a non-contrast maxillofacial CT obtained over a 24-month period.

Scans were stratified into one of six non-contiguous age groups: <24 months (n=8), 3-4 years (n=9), 6-7 years (n=9), 9-10 years (n=8), 12-13 years (n=9), or 15-16 years (n=9). For each of the subjects, the electronic medical record was reviewed for the presence of aberrant craniofacial or skull base anatomy. Each cohort was comprised of 6-7 patients. Ten maxillofacial CT scans of adult patients who met the same criteria were reviewed.

The distance from the mucosa to the orbit (GPF-OF) was calculated as the sum of three independent measurements: the width of the mucosa overlying the GPF (Mucosa), the distance traversed by the greater palatine canal (from the GPF to the PPF) (GPC), and the distance from the base of the PPF to the floor of the orbit (PPF).

**RESULTS**

The mean values of GPC length, SPF length, and distance from GPF to orbital floor changed significantly between contiguous age cohorts from <24 months (Figure 1) to 12-13 years of age (p<0.05). However, these dimensions showed no statistically significant changes between 12-13 and 15-16 years of age or between these two groups and the adult cohort (p>0.05), signifying cessation of the active growth phase of these structures prior to these ages. The mean values of each measurement and corresponding p-values for the statistical comparisons between non-contiguous age groups are displayed in Tables I and II. No statistically significant differences in these measurements were found between the right and left sides in these subjects.

**DISCUSSION**

These radioanatomic results suggest that the greater palatine canal injection could be safely performed pediatric patients. In performing this injection, the goal should be to maximize safety of the intra-orbital contents by minimizing the depth of insertion required to access the pterygopalatine fossa. In patients >12 years of age, the injection can be performed in the manner presently described for adult patients, whereby the needle is bent to an angle of 45 degrees at distance of 25mm from the needle tip. This would effectively maintain a distance of 20mm between the needle tip and the orbital floor. In patients between 6 and 12 years of age the needle may be inserted up to 20mm, also remaining 20mm from the orbital floor. In our youngest age groups (less than 6), the needle may be safely inserted to a depth of 12mm, thereby keeping the needle tip 15mm from the orbit. All of these measurements place the needle in the superior third of the GPF. The injection of injectant while maximizing the distance from the orbital contents.

Due to the purely radioanatomic nature of this study caution should be exercised in interpreting these results for clinical use. Correlation of these findings through a larger prospective clinical design would be useful in assessing the safety, reproducibility and efficacy of this technique in clinical practice.

**CONCLUSIONS**

These radioanatomic results suggest that the GPC injection described for adult patients may be safely administered to selected pediatric patients. For patients >12 yrs, we recommend bending the needle 45 degrees and inserting it 25mm. For patients 6 to 12 yrs, the needle should be inserted 20mm to enter the PPF. In patients <6 yrs, the needle may safely be placed 12mm into the GPC. Each of these descriptions is based on the minimal distance required to effectively access the PPF, with maximal safety in regards to the orbit. There remains a need for clinical correlation of these findings through future investigation.

**REFERENCES**