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A method of radiographic guiding for maxillary nerve block (pterygopalatine fossa oblique view)

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Maxillary nerve block is considered the most difficult among the techniques of trigeminal nerve block. The difficulty may be associated with the following factors: (1) Insertion of a block needle into the pterygopalatine fossa is sometimes troublesome due to anatomical variations in the shape of the anterior edge of the lateral pterygoid palate of the sphenoid, which is the first target of this block. (2) The occurrence of vascular puncture or ocular complications may be more frequent due to repeated insertion [1–3]. (3) Although trigeminal neuralgia occurs most frequently in the second division, 80% of the cases may be treated by infraorbital nerve block. Therefore, physicians have less access to the cases that call for maxillary nerve block, the technique which takes time to master. (4) The diameter of the maxillary nerve is small compared to that of the mandibular nerve. (5) The fact that the occipito-mental projection, known as the only established radiographic method to confirm needle direction, is incapable of indicating the direction to the pterygopalatine fossa may be the major reason making maxillary nerve block even more difficult, associated with a low rate of success. To solve this problem, we devised the pterygopalatine fossa oblique view for clinical application during the procedure of maxillary nerve block.

Before clinical trials of the new fluoroscopic method of maxillary nerve block, the angles formed between the tangential direction of the pterygopalatine fossa and the sagittal plane (angle A) and between the tangent of the orbital floor and the Deutsche Horizontale (angle B) were measured in a cranial bone specimen as the standard for actual nerve block. The angles of the eyes and the bone are as shown in (Fig. 1a). Angles A and B were 62° and 20°, respectively. When these results are applied to actual maxillary nerve block, the patient is placed in the spine position with the head rotated approximately 62° opposite to the block side, and the C-arm is tilted 20° in the caudal direction (Fig. 1b).

Based on the measurement results, the fluoroscopic method was determined for six patients who were to undergo maxillary nerve block with trigeminal neuralgia and trigger area in the second branch. All the patients had been informed of the aim of this study, and their consent obtained. The patients were placed in the supine position with a doughnut-type pillow (5 cm in height) with the face rotated approximately 62° opposite to the block side. The C-arm was tilted 20° in the caudal direction. For some patients, clear visualization of the pterygopalatine fossa was obtained on the fluoroscopic television with this setting of directions. However, when this setting failed to obtain a clear view of the pterygopalatine fossa, the patient's head and the C-arm were rotated further to determine the appropriate direction of X-ray fluoroscopy for clearest visualization of the fossa, and the rotated angles of the patient's head and the C-arm were recorded accordingly.

Maxillary nerve block was performed by the lateral extra-oral method [4] in all of the patients under light sedation with 3 to 10 mg of diazepam and 0.1 mg of fentanyl. After aseptic preparation of the skin, a skin wheal was formed by 1% lidocaine below the sigmoid notch of the zygomatic arch 3 cm anterior to the tragus. A 7-cm, 21-gauge needle was introduced into the skin and slowly advanced to top the angle formed by the orbital floor and the posterior wall of maxillary sinus, while the pterygopalatine fossa was monitored on a fluoroscopic television (Fig. 2a). One-half milliliter of 2% lidocaine containing contrast medium was injected

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after the needle tip had been inserted into the pterygopalatine fossa, and radiating pain was observed in the area innervated by the maxillary nerve. Two radiographs were taken immediately (the directions corresponding to that of fluoroscopy and occipito-mental projection), and the findings were evaluated concerning the spread of contrast medium. Thereafter, 0.5 ml of 99.5% ethanol was injected after sensory loss was confirmed in the maxillary nerve-innervated area, and it was confirmed that no other cranial nerve dysfunction existed.

However, in actual fluoroscopy, the appropriate angle between the face and the perpendicular axis (angle A) was 55°–62° (mean, 59.2°) and the tilting angle of the arm (angle B) was 25°–32° (mean, 27.2°) (Table 1). Although a slight variance exists among the patients, these angles may be readily determined in all of them. The needle can be easily guided for insertion while the pterygopalatine fossa is monitored on the fluoroscopic television. Blocks were successfully performed within 1 h in all the patients, and no complication was observed in any of them. Figure 2a shows the pterygopalatine fossa oblique view. The needle tip is

Table 1. Final X-ray projection angles for visualizing the pterygopalatine fossa in the six patients

Case No.	Age	Sex	Angle A°	Angle B°
1	82	F	55	27
2	79	F	58	27
3	59	M	62	28
4	59	F	60	32
5	61	F	58	25
6	78	M	62	27
Mean	69.7		59.2	27.7
Range	59–82		55–62	25–32

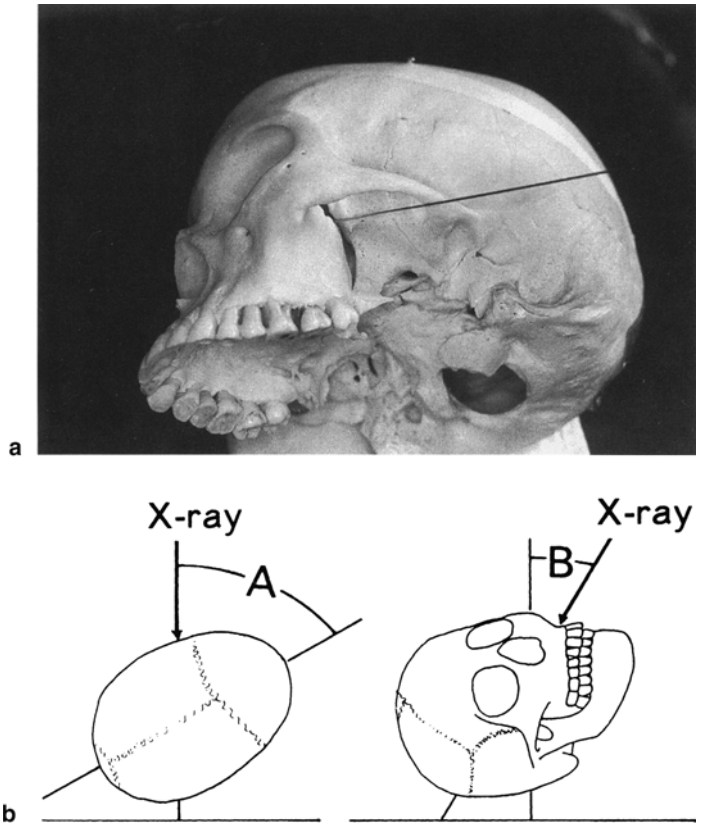

Fig. 1. **a** Pterygopalatine fossa and block needle seen from the direction of X-ray. **b** X-ray projection angles for visualizing the pterygopalatine fossa

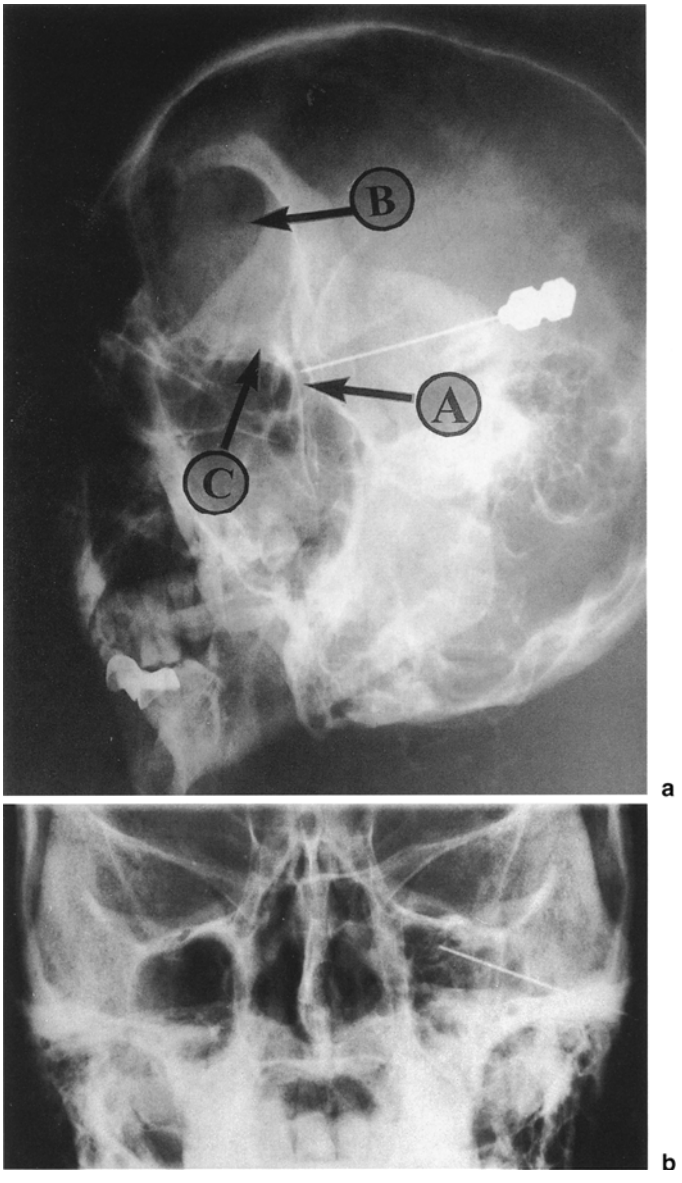

Fig. 2. **a** Radiograph showing the final location of the needle tip during maxillary nerve block (pterygopalatine fossa oblique view). A, Pterygopalatine fossa, B, orbit, C, orbital floor. **b** Occipitomental view. The maxillary nerve was visualized in the form of negative relief close to the needle tip

located in the pterygopalatine fossa, and contrast medium flows toward the orifice of the infraorbital canal. Figure 2b shows the conventional occipito-mental projection. After injection of contrast medium, the maxillary nerve is shown in the negative relief close to the needle tip.

The occipitomental projection is presently the only generally accepted radiographic method available for maxillary nerve block [5–8]. This method is of value in indicating the relationship between the needle tip and both the foramen rotundum and the orifice of the infraorbital canal. However, since the pterygopalatine fossa cannot be visualized by this method, this method alone fails to secure a physician's confidence in the direction of insertion. This factor makes the method an inappropriate guide for insertion of a needle into the pterygopalatine fossa.

The first barrier in the procedure of maxillary nerve block is the insertion of a needle into the pterygopalatine fossa. However, there being no established method to confirm the correctness of the insertion of a block needle into the fossa, we considered the barrier would be cleared by establishing an adequate radiographic method with which to obtain a clear image of the pterygopalatine fossa. As a radiographic method other than occipitomental projection for maxillary nerve block [9,10], only lateral imaging of the cranial bone has been reported in the past. Whereas the direction of the X-ray parallels the frontal plane in the lateral image, the tangent of the pterygopalatine fossa leans approximately 30° away from the frontal plane according to our measurement. Since the tangent of the fossa and the direction of the X-ray are not in parallel with each other, the fossa is not clearly visualized, and it is deviated from the fossa's actual entrance, even if the fossa is ever projected. These factors make the lateral image useless as a guide for needle insertion during maxillary nerve block. On the basis of the measurement of the angles of the fossa in dry skull, we rotated the projection of the X-ray approximately 30° from the frontal plane so that the X-ray and the fossa would be in parallel with each other. Furthermore, we rotated the angle of X-ray about 27° from the Deutsche Horizontale so that the X-ray and the tangent of orbital floor would be in parallel while the contralateral pyramid and bilateral zygomatic bone would be avoided at the same time. As a result, we succeeded in clear visualization of the fossa and the orbital floor by directing the X-ray to take two different axes of rotation, as the unprecedented method not reported in the past. For diagnosis of bone fracture, a radiographic method reported by Potter visualized the right and the left pterygopalatine fossas as separate entities by rotating the patient's head 10° away from the lateral position [11]. However, a visual image of upgraded clarity for the pterygopalatine fossa and orbital floor is obtained with our new method rather than that of Potter's. Our method enables a block needle to be guided readily into the fossa during nerve block. In addition, clear visualization of the orbital floor helps eliminate misinsertion of a block needle into the orbit. However, since the depth of the needle tip cannot be determined by our method alone, conventional occipitomental projection is more suitable for the determination of needle depth. Needle placement will thus enhance safety and precision through a effective combination of the new pterygopalatine fossa oblique view and the conventional occipitomental projection.

In conclusion, we devised the pterygopalatine fossa oblique view for maxillary nerve block to be applicable as a fluoroscopic guide.

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