

Description of a novel anatomical  
venous structure in the nasoglabellar area

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# Description of a novel anatomical venous structure in the nasoglabellar area

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This certifies that the Master's Thesis of  
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저는 지금 저의 학문의 길에서 한 고지를 넘고 있습니다. 제가 해부학이라는 학문에 들어설 수 있게 도와주신 모든 분들께 감사드립니다. 2006년 본과 1학년 때의 만남을 시작으로 지금까지 8년 동안 언제나 옆에서 지켜보면서 올바른 학문의 길로 인도해주신 김 희진 교수님께 가장 큰 감사를 드립니다. 또한, 저에게 언제나 큰 등불이 되어 주시는 허 경석 교수님과 박 종태 교수님께 감사를 드립니다. 이 논문이 완성되기 까지 바쁘신 와중에도 힘이 많이 되어주신 노승오, 정 찬세, 김 현석 원장님과 병원의 모든 식구들에게도 감사의 마음을 전합니다. 여러 가지 바쁜 일 중에도 항상 열심히 하며 자기 일처럼 실험을 도와주신 이 형진 선생님과 해부파트 모든 조교 선생님들께도 감사의 마음을 전합니다.

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저자 씀

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Abstract

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Injectable dermal fillers are frequently used to reduce the appearance of various facial creases and rhytids. However, venous complications can develop while injecting dermal filler, especially in the nasoglabellar area. The aim of this study was to determine the anatomic patterns of the veins in the nasoglabellar area and to elucidate their detailed location with reference to various facial landmarks. Forty-one heads from Korean and Thai cadavers were dissected. When the anastomosing vein between the bilateral angular veins (AVs) was located in the nasoglabellar area, it was designated the “intercanthal vein” (ICV). The bilateral AVs continued as the facial vein without any communicating branches in 12 cases (29.3%). At the radix of the nose, the AV communicated with the ICV, connecting them bilaterally. The ICV was found above (type IIa) and below (type IIb) the intercanthal line in 26 (63.4%) and 3 cases (7.3%), respectively. The ICV can be regarded as a candidate causative site for the frequent complications associated with dermal filler injection in the nasoglabellar area, and utmost care should be taken when injecting in this area, such as when performing radix augmentation and

softening wrinkles in the glabellar area.

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Key words : Angular vein, Dermal filler injection, Glabellar area, Interanthal vein, Venous anatomy

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## I . INTRODUCTION

Injectable dermal fillers are frequently used to reduce the appearance of various facial creases and rhytids, such as glabellar wrinkles, the nasolabial fold, nasojugal fold, and tear-trough deformity (Glaich et al., 2006; Lorenc et al., 2013; Daines and Williams, 2013). Dermal filler injection can be particularly effective in treating the horizontal and vertical glabellar wrinkles that appear inevitably with aging in many individuals (Carruthers and Carruthers, 2010). However, some vascular complications can develop after dermal filler injection, including tenderness, swelling, and ecchymosis (Glaich et al., 2006; Sclafani and Fagien, 2009; Park et al., 2011; Rodrigues-Barata and Camacho-Martinez, 2013).

Vascular accidents can occur not only as a result of direct intravascular

injury from the needle but also due to the exertion of extravascular compression without immediate arterial damage (Glaich et al., 2006; Sclafani and Fagien, 2009). In the nasoglabellar area, unsuitable manipulation during dermal filler injections can disturb some parts of the arterial vasculature, such as the supraorbital, supratrochlear, dorsal nasal, and angular arteries (Schanz et al., 2002; Glaich et al., 2006; Peter and Mennel, 2006; Park et al., 2012).

Similarly, these injections may also cause venous injuries that can result in continuous dull pain, dark discoloration, and bruising. Furthermore, delayed and persistent venous occlusion may develop (Park et al., 2011). In addition, the injection of large amounts of filler particles into a limited area can cause venous obstruction and occlusion (Sclafani and Fagien, 2009). These potentially serious complications of dermal filler injection to the glabellar area can be avoided only with detailed knowledge of the vascular structures in that area.

The facial vein (FV), angular vein (AV), supratrochlear vein (STV), and supraorbital vein (SOV) are located superficially in the forehead. The veins of the face are typically characterized by their straight course, thin vascular walls, abundant anastomoses, and lack of venous valves. In particular, the SOV and STV interflow forms the AV in the glabellar area, which connects with the cavernous sinus within the cranial cavity through the superior ophthalmic vein (Standring, 2008). Thus, filler particles could potentially invade the cavernous sinus via the AV during injectable filler augmentation to the face, with potentially significant implications. Knowledge of the location of the AV relative to clinical landmarks on the face is essential to avoid such vascular accidents. Furthermore, the AVs on both sides can join in the glabellar area, and the area of this venous confluence might be particularly susceptible to damage during injectable filler treatment.

Since these veins are at risk of infection, various cadaveric studies have been performed to specify the meticulous arteriovenous anatomy and to outline

the angiosomes of the head (Taylor et al., 1990; Houseman et al., 2000; Kleintjes, 2007; Hou et al., 2013; Shimizu et al., 2013). The variations in the arterial anatomy of the forehead region, and the relationship between these arteries and their contiguous veins have also been examined (Kleintjes, 2007). These previous studies examined only the side-view venous structures of the glabellar area, and the precise anatomy of the veins around the glabella was not specifically revealed.

Therefore, the aim of this study was to clarify the topography of the veins in the nasoglabellar area and to establish their detailed location with reference to the facial landmarks, thereby providing anatomic guidelines that will enable the clinician to avoid some of the clinical complications associated with dermal filler injection to the nasoglabellar area.

## II. MATERIALS & METHODS

Forty-one heads - 29 embalmed (19 males, 10 females; mean age 72.4 years) and 12 fresh (9 males, 3 females; mean age 87.7 years) - from Korean and Thai cadavers were used in this study. The skin of the middle and upper facial area was delicately removed and the subcutaneous tissue was dissected to disclose the blood vessels in the forehead region, including the glabella. Careful attention was paid when dissecting the glabellar area, including the STN, SOV, AV, and FV within the subcutaneous layer, in order to distinctly show their structures (Fig. 1).

The line connecting the right and left medial canthi [intercanthal line (ICL)] was used as a reference line. When the anastomosing vein between the bilateral AVs was found in the nasoglabellar area, it was designated the "intercanthal vein" (ICV). The location of the ICV was classified into two main types (I and II) as follows, with type II being subdivided further into types IIa and IIb, according to its location relative to the ICL:

- Type I: Cases in which there was no ICV in the intercanthal area, but an anastomosing branch between the STV in the glabellar area was observed.
- Type IIa: Cases in which the ICV was located above the ICL at the radix of the nose.
- Type IIb: Cases in which the ICV was located below the ICL at the radix of the nose.



Figure 1. The venous structures of the nasoglabellar area were delicately dissected, including the supratrochlear vein (STV), the supraorbital vein (SOV), the angular vein (AV), and the facial vein (FV).

### III. RESULTS

In every case of type I (29.3%, 12/41), a single vein was observed along the midsagittal line of the forehead that divided into two branches in the glabellar area. Each vein descended obliquely to the medial side of the orbit to reach the SOV and STV, where it became the AV. The bilateral AVs continued as the FV without any communicating branches in type I (Fig. 2).

In type II, ICV was observed in the nasoglabellar area (70.7%, 29/41). At the level of the radix of the nose, the SOV and STV joined to form the AV; the ICV connected the bilateral AVs. Types IIa and IIb were observed in 63.4% (26/41) and 7.3% (3/41) of cases, respectively (Fig. 2).

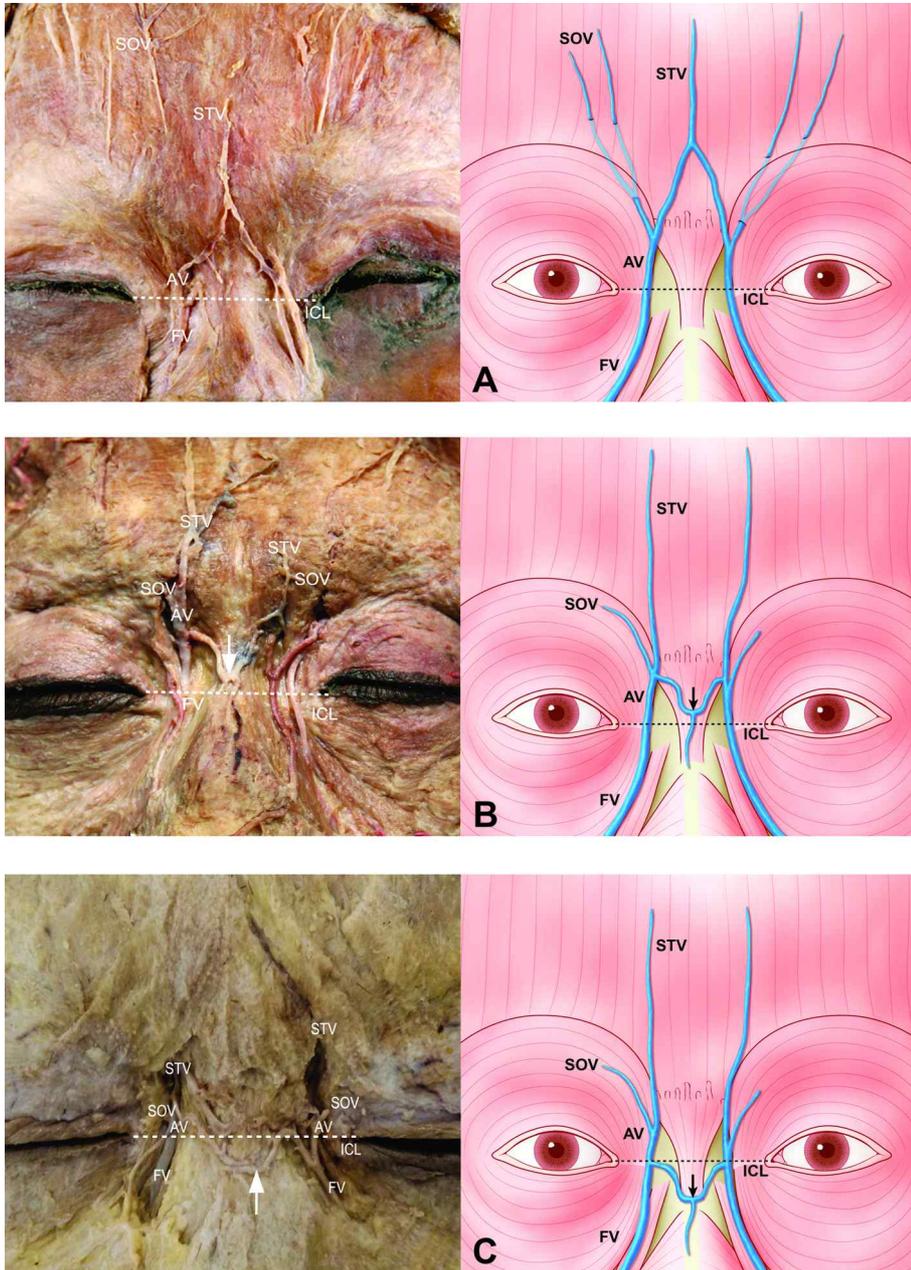


Figure 2. Photographs and illustrations showing the three topographical patterns of intercanthal vein (ICV) observed in the nasoglabellar area. (A), Type I: near the midsagittal line, a single supratrochlear vein (STV) divides

into two branches in the glabellar area. Each of the branches of the STV runs obliquely downward close to the medial canthus to meet the supraorbital vein (SOV), ultimately becoming the angular vein (AV). The bilateral AVs continue on as the facial vein without any communicating branches at the level of the radix of the nose. (B), Type IIa: the ICV is located above the intercanthal line (ICL). (C), Type IIb: the ICV is located below the ICL in the nasoglabellar area. The arrows indicate the ICV and the dotted line represents the ICL.

## IV. DISCUSSION

The venous anatomy of the nasoglabellar area has received little attention from dermatologists and plastic surgeons because they were thought to have little clinical significance. However, in the case of dermal filler injection, it is necessary to know the precise anatomy of the venous structures of the nasoglabellar area to avoid the various known clinical complications associated with that surgical protocol.

To date, the general anatomy textbooks state only that the AV is formed by union of the SOV and STV in the nasoglabellar area, and that it proceeds downward as the FV (Moore and Dalley, 2006; Standring, 2008).

Contrary to that description, Shimizu et al. recently demonstrated that the bilateral AVs join in the glabellar area, from where this communicating vein was designated the transverse nasal root vein (Shimizu et al., 2013). This vein can be readily encountered within the subcutaneous layer of the nasoglabellar area during dissection, but anatomists tend to disregard it since it is thought to have little clinical significance. In the present study, this venous structure was designated the ICV at the level of the ICL. The entire venous network of the nasoglabellar area could not be identified with the naked eye; only veins with a diameter of a few millimeters could be seen.

In terms of dermal filler injections, the intercanthal area is very important for improving the height of the radix of the Asian nose and reducing the appearance of vertical and horizontal glabellar wrinkles. Injections are usually performed using a 27~28G needle through a pinching of the radix of the nose (Carruthers and Carruthers, 2010). Although this injection technique is relatively safe and easy to perform, some side effects can occur after treatment, including bruising as a result of puncture of the ICV at the level of

the ICL.

The venous structures in the nasoglabellar area in the present study were classified into three categories based on their location relative to the ICL. The existence of the ICV as a single vein around the ICL (type II) was observed in 70.7% of cases. All ICVs were joined by the bilateral AV at the level of the radix of the nose and located within the subcutaneous tissue of the nasoglabellar area on the procerus muscle. These findings suggest that aspiration prior to injection is essential to avoid puncturing the venous structure in the intercanthal area. The other cases (29.3%) comprised type I, a single vein along the midsagittal line of the forehead.

In the nasoglabellar area, the radix of nose is regarded as a potentially danger triangular zone of the face. Since the AV is linked with the FV, it continues to the superior ophthalmic vein to arrive at the cavernous sinus within the cranial cavity, which could thus be potentially affected by damage to that external danger triangular zone of the face (Moore and Dalley, 2006; Standring, 2008). Since the ICV is one of the tributaries of the AV, direct puncture through the ICV may cause filler particles to be conveyed into the cavernous sinus via the AV and superior ophthalmic vein.

In conclusion, iatrogenic damage to the ICV may be regarded as one of mechanisms underlying the complications that occur frequently following dermal filler injection (Park et al., 2011; Sclafani and Fagien, 2009). The nasoglabellar area should thus be treated with utmost care when performing dermal filler injection for treatments such as radix augmentation and softening wrinkles in the glabellar area.

## V . CONCLUSION

The conclusions of this study are as follows.

1. The existence of the ICV as a single vein around the ICL was observed. All ICVs were joined by the bilateral AV at the level of the radix of the nose and located within the subcutaneous tissue of the nasoglabellar area on the procerus muscle.

2. These findings suggest that aspiration prior to injection is essential to avoid puncturing the venous structure in the intercanthal area.

3. Iatrogenic damage to the ICV may be regarded as one of mechanisms underlying the complications that occur frequently following dermal filler injection. The nasoglabellar area should thus be treated with utmost care when performing dermal filler injection for treatments such as radix augmentation and softening wrinkles in the glabellar area.

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Abstract (in korean)

## 필러 주입 시 주의해야할 미간 부위에서의 새로운 해부학적 정맥 구조

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### 강 인 원

미간부위에서 도르래위정맥은 눈확위정맥과 만나며, 안쪽눈구석 부위에서 눈구석정맥을 이룬다. 이 정맥은 위눈정맥을 통하여 해면정맥굴로 들어간다. 미간부위에서 피판술 (flap surgery) 및 필러 (filler) 주입 시술 시 정맥의 형태 및 위치는 임상적으로 중요하나, 이에 대한 연구는 거의 없는 실정이다. 따라서 미간 및 코뿌리부위에서 정맥의 해부학적 형태학적 형태 및 특징을 관찰하고, 이에 대한 임상해부학적 자료를 제시하고자 이 연구를 시행하였다.

재료로는 한국인 성인 시신 29구 (남성: 19구, 여성: 10구, 평균나이: 72.4세)와 태국 성인 시신 12구 (남성: 9구, 여성: 3구, 평균나이: 87.7세)를 사용하였다. 피부를 벗긴 후 도르래위정맥, 눈확위정맥, 눈구석정맥, 얼굴정맥을 해부하였다. 코뿌리부위에서 양쪽눈구석을 연결하는 하나의 정맥을 관찰하였으며 이 정맥을 눈구석사이정맥 이라고 명명하였다. 또한 양쪽안쪽눈구석을 연결한 선 (intercanthal line, ICL)을 기준으로 형태에 따라 3가지로 분류 하였다. Type I은 양쪽눈구석정맥이 서로 만나지 않고 턱뼈각을 향하며 얼굴정맥으로 계속되는 형태로 29.3% (12구/41구)에서 관찰할 수 있었다. Type II는 양쪽눈구석정맥이 눈구석사이정맥으로 서로 연결되었으며 Type IIa는 ICL 위쪽에서 연결되는 형태, Type IIb는 ICL 아래쪽에서 연결되는 형태로 각각 63.4% (26구/41구), 7.3% (3구/41구)에서 관찰할 수 있었다.

본 연구에서는 기존 연구에서 밝혀지지 않았던 눈구석정맥의 해부학적 형태를 관찰할 수 있었다. 특히 양쪽눈구석정맥이 미간과 코뿌리 부위에서 서로 만나는

양상을 관찰할 수 있었다. 이러한 연결양상은 필러 (filler) 주입 시술 시, 필러 입자가 판막이 존재하지 않는 위눈정맥을 통해 해면정맥굴로 유입될 수 있으며, 이는 심각한 부작용을 초래할 수 있는 해부학적 원인 중 하나로 생각할 수 있다. 따라서 본 연구에서 얻어진 눈구석정맥의 연결양상에 관한 해부학적 자료는 외과적 피판술 (flap surgery) 및 필러 (filler) 시술 시, 중요한 임상해부학적 자료로 활용할 수 있을 것으로 생각한다.

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핵심되는 말 : 눈구석정맥, 미간, 코뿌리, 미용 성형, 필러 시술