Commentary

Commentary on: Three-Dimensional Arterial Distribution Over the Midline of the Nasal Bone

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The authors of this paper, Drs Cong, Liao, Zhang, Li, and Luo, are to be congratulated for their neatly thought-out and performed computed tomography (CT) topographic study[1] which analyses the 3-dimensional (3D) arterial network over the nose in 79 Asian cadavers, with the intention of determining how many of these major arteries traverse the midline of the nose, at which level in the overlying soft tissue of the nose, and at what depth. The authors aim to thereby develop clinical strategies that best avoid these vessels during filler injection treatments on the nose. They have also rounded out the article with a sensible and meaningful discussion that will be useful to all clinicians who inject fillers into the nose.

Why is the midline so important? In Asia, injection augmentation rhinoplasty is one of the most highly requested and frequently performed cosmetic treatments in the face.[2,3] The Asian face tends to be broad, square, and flat with less vertical height and anterior projection of the nose and chin than Caucasian counterparts. Raising the nasal bridge and enhancing tip projection increases anterior projection, reduces the bulginess of the eyes, and creates a 3D and more aesthetically pleasing midface. Hence, the popularity of any form of surgical or nonsurgical augmentation rhinoplasty among Asian cosmetic patients.[4-6]

Because the nose is a midline structure, injection rhinoplasty is performed in 2 ways, either by means of a cannula directed along the midline of the nose with retrograde injection of the filler material, or by means of a sharp needle and injecting directly onto the midline bone and cartilage as discontinuous preperiosteal or submuscular pellets. The results for both methods are instantaneous and highly gratifying.

However, the rise of this seemingly simple technique, together with filler and facial fat injections to the face, forehead, and temples, has also brought with it a host of severe complications that were never seen before the advent of these techniques in the early 1990s. Skin necrosis, blindness, strokes, and even deaths are the dire modern-day consequences of inadvertent facial filler embolism into the branches of the ophthalmic arteries, which have only been documented in the last 30 years. Over 200 cases of blindness[8-10] and 43 cases of cerebral strokes[11] have been officially recorded during this period, a large majority of them from Asia.

It is therefore vital to understand the arterial anatomy of the nose, its depth, its most frequent variations, where any significant arterial branches may be encountered in the midline, and the anastomotic channels that exist between the external carotid artery system (branches of the facial artery) and the internal carotid artery system (ophthalmic artery and its branches such as the supratrochlear, supraorbital, and dorsal nasal arteries), which allow these embolic complications to occur.

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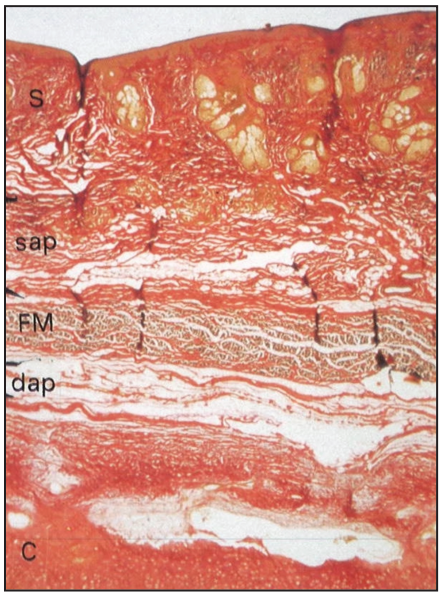

Figure 1. The 5 layers of soft tissue overlying the osseocartilaginous framework of the nose; hematoxylin and eosin stain, 4× magnification. C, cartilage; d.a.p., deep areolar plane; FM, fibromuscular layer; S, skin envelope; s.a.p., subcutaneous areolar plane.

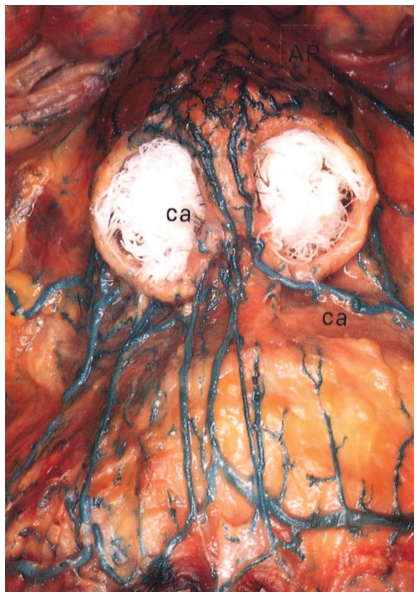

Figure 3. Arterial supply of the nose (variations 1 and 3): on the left side, the columellar artery (c.a.) is seen to arise from the branching of the facial artery into the c.a. and alar artery (a.a.). On the right side, the c.a. arises from the superior labial artery (SLA) (variation 3). The tip plexus is seen to be derived from branches of the alar, columellar, and dorsal nasal arteries. AP, arterial plexus. Images reproduced with permission from the *Annals of Academy of Medicine Singapore*.

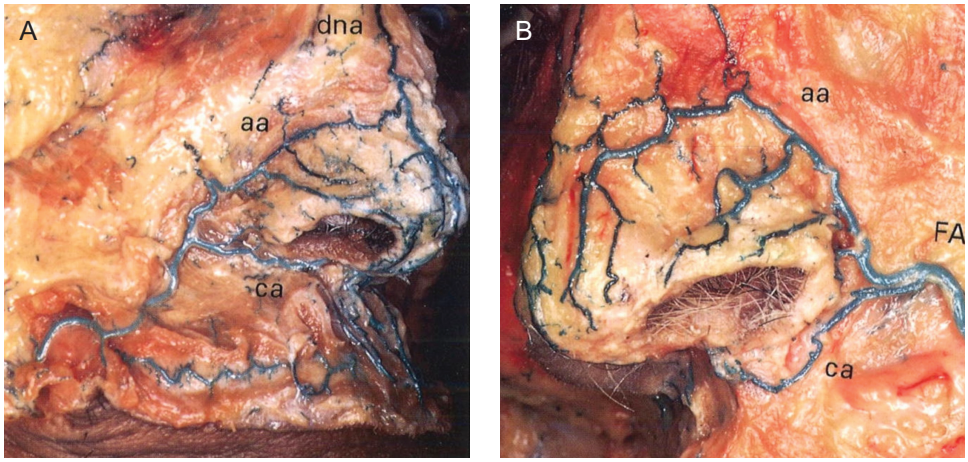

Figure 2. (A) Arterial supply of the nose (variation 4): the alar artery (a.a.) is seen to anastamose with the dorsal nasal artery (d.n.a.) which remains of large bore and runs down to the nasal tip to enter into the dense alar and tip plexus. (B) Arterial supply of the nose (variation 2): the alar artery (a.a.) continues around the alar groove giving off branches in a cascade fashion that ultimately supply the alar and tip plexus. The columellar artery (c.a.) runs beneath the nostril sill to the base of the columellar. FA, facial artery. Images reproduced with permission from the *Annals of Academy of Medicine Singapore*.[7]

To this end, the authors of this paper have conducted an extensive CT analysis of the nasal arteries in 79 Asian cadavers, and devised a simple grid of 8 rectangular segments that, when placed over the nose, allows us to quantify how many major arteries are seen in each of these segments and also how many times and at what level we

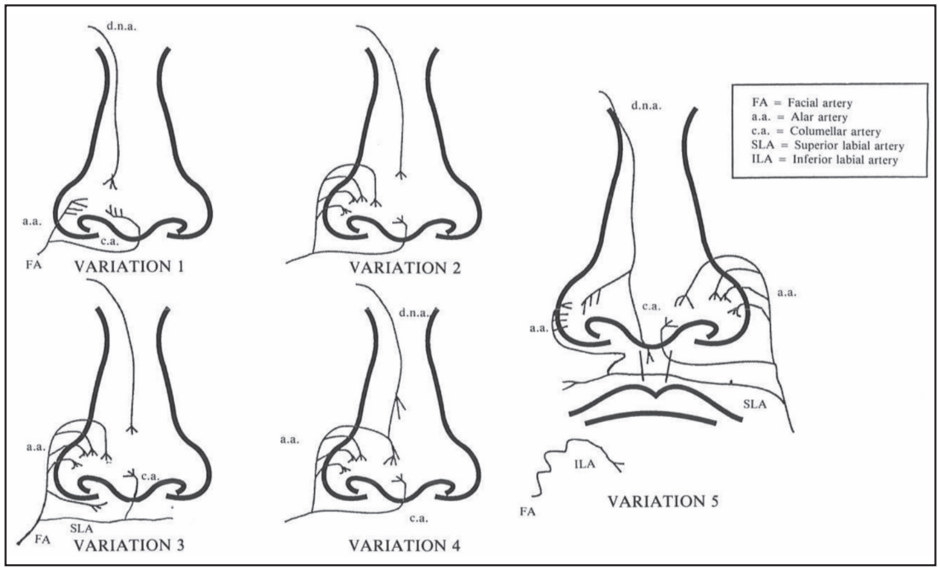

Figure 4. Variations in the arterial supply of the oriental nose: findings in 20 facial arteries. a.a., alar artery; C, cartilage; c.a., columellar artery; d.a.p., deep areolar plane; d.n.a, dorsal nasal artery; FA, facial artery; FM, fibromuscular layer; ILA, inferior labial artery; S, skin envelope; SLA, superior labial artery; s.a.p., subcutaneous areolar plane. Image reproduced with permission from the *Annals of Academy of Medicine Singapore*.[7]

are most likely to encounter an arterial branch or variation in the midline of the nose, where most filler injections are performed. The boundaries of this grid are horizontal lines that pass through the supraorbital rim superiorly and the rhinion inferiorly, and vertical lines that pass through the bilateral medial orbital rims creating a central rectangle, further divided into 2 vertical rows of 4 rectangular segments on each side of a vertical midline (8 segments in total). These are called the left and right S1 to S4 segments and on the midline there are 5 points (P1-P5) numbered from the highest to the lowest point of this grid. The authors have quantified that the probability of encountering an arterial branch at each of these P1 to P5 points (along the midline) is 6.3%, 5.1%, 1.3%, 7.6%, and 11.4% respectively.

The anatomy of the Oriental nose, including its arterial supply and variations, has previously been studied and described.[7] There are 5 layers of soft tissue, each about a millimeter thick, that overlie the osteocartilaginous framework of the nose, namely the skin, subcutaneous areolar plane, fibromuscular layer, deep areolar plane, and periosteum or perichondrium (Figure 1). The fibromuscular layer is an unbroken sheet of soft tissue made up of the muscles of the nose that run continuously with the superficial musculoaponeurotic system of the face.

The arterial supply of the nose, derived either from the facial artery (columellar and alar arteries) or the ophthalmic artery (dorsal nasal arteries), runs on the surface of this fibromuscular layer with only a few small branches that penetrate the muscle itself.

The arteries of the nose run in pairs which independently supply each side of the nose, their terminal branches

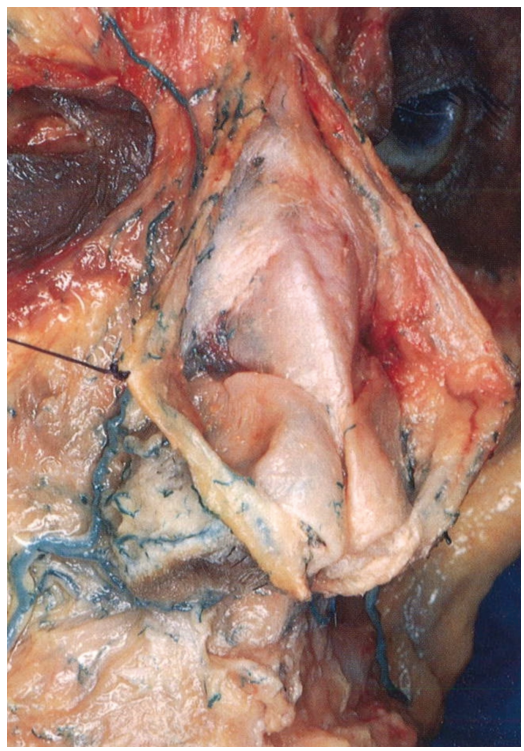

Figure 5. Avascular plane below the fibromuscular layer: the fibromuscular layer has been incised along the midline and reflected like the pages of an open book to expose the underlying osseocartilaginous framework, which is devoid of any major arteries. The arteries of the nose are seen to all run on the surface of the fibromuscular layer. Image reproduced with permission from the *Annals of Academy of Medicine Singapore*.[7]

converging at the midline (Figure 2). These arteries enter into a dense arterial plexus only over the tip subunit, leaving an apparent arterial watershed over the dorsum of the nose in the midline (Figure 3). However, there are many variations of anatomy and sometimes a major nasal artery or its branches can run along or even across the midline (Figure 4). If the fibromuscular layer is reflected off the nasal framework at the level of the deep areolar layer, there are virtually no major nasal arteries to be seen on its undersurface, making this a relatively avascular and safe plane for injection (Figure 5).

For 2 decades, this author has advocated the use of sharp needles to inject the filler material directly and deeply onto the bone or cartilage in the midline, thereby avoiding the major arterial branches that run more superficially on the surface of the fibromuscular layer.[2,3] This is corroborated by the present study by Cong et al, which confirms that the skin, subcutaneous fatty areolar plane, the muscular layer, and the deep fatty areolar layers are each 1 mm thick and that the main arteries of the nose run at a depth of approximately 2 mm below the skin surface, which in turn, corresponds to the surface of the fibromuscular layer.

Although a cannula is perceived to be a safer instrument because it has a blunt tip, it is in fact difficult to consistently deliver the filler material deeply below the plane of the major arteries. Instead, a cannula has a natural tendency to direct itself into planes of least resistance which are encountered in the subcutaneous fatty areolar plane or in the fibromuscular layer, which unfortunately is where most of the major arteries run. However, with a sharp 30G or 29G needle, the filler can be accurately injected deep onto the bone thus avoiding the overlying plane of the arteries. With so many severe complications that can occur after an injection rhinoplasty, it is clear that we should re-examine the way we perform this procedure, and hopefully this highly informative paper of Cong et al may persuade us to inject as deeply as possible with sharp needles, on the midline of the nose, to minimize or even avoid these dreaded complications.

Disclosures

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