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The superficial venous drainage of the breast: A clinical study and implications for breast reduction surgery☆

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Summary *Background:* An understanding of the vascular anatomy of the breast is paramount in breast reduction surgery in order to minimize vascular complications. While most vascular compromise in breast reduction is largely venous in nature, the venous anatomy of the breast has not been sufficiently explored in the literature, particularly the inferior pole of the breast. Developments in infrared photography have enabled the use of this noninvasive technique to evaluate the venous architecture of the breast.
Methods: 32 voluntary participants (26 female, 6 male) underwent infrared photography of the superficial veins of the breast. Using a modified technique, the venous architecture of the breast, with an emphasis on the inferior pole veins, was evaluated.
Results: Infrared photography was able to clearly demonstrate the superficial veins of the breast in all cases. The subareolar plexus and pattern of venous radiation from this plexus were evident, with a predominant pattern of superomedial and inferior pole drainage seen. Although the dominant drainage route was via the third and fourth intercostal spaces, two patterns of drainage were noted: superomedial drainage to the 2nd and 3rd intercostal spaces (29 out of 29 cases) and lower pole drainage to the 4th and/or 5th intercostal space (27 of 29 patients — 93.1%).
Conclusion: The venous architecture of the breast is demonstrated clearly with the techniques described, enabling the improved planning of breast reduction pedicles. Preservation of the superficial venous drainage as well as the arterial supply can help to mini mize the incidence of vascular complications.

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Background

An understanding of the vascular anatomy of the breast is paramount in breast reduction surgery. To minimize vascular complications, different breast reduction pedicles have been described. However, it has largely been the arterial supply of the breast that has been the key determinant in the design of these surgical techniques,[1–5] and yet vascular compromise in breast reduction is largely venous in nature.

Despite the clear clinical need, the venous anatomy of the breast has not been sufficiently explored in the literature. Dissection studies provided the early anatomical descriptions, with Cooper (1840) demonstrating the veins by dissection after coloured gelatin injection.[6] He showed that the veins of the breast were divisible into superficial and deep systems, with the deep veins associated with arteries. Ricbourg (1992) used latex injections of the vasculature followed by dissection to explore the breast veins in further detail.[7] He demonstrated a rich and constant superficial venous system, which was more visible in the superior quadrants of the breast, and ran an extensive subcutaneous course which was continuous with the surrounding superficial venous system of the body. Deep veins accompany the arterial supply as concomitant veins, forming a network in the lateral axis by the lateral thoracic vein and the medial axis by the venae comitantes of the 2nd to 5th internal thoracic perforators.[8]

With the advent of imaging technologies, radiographic studies have been subsequently sought, however cadaveric anatomical studies of these veins were not been widely performed, given the difficulties with venous valves obstructing radiographic injection. Taylor et al. (1990) explored the venous drainage of the anterior chest wall and confirmed the difficulties encountered, showing only partial filling of the venous network after injection.[8] Infrared photography has since been used as a tool to highlight the superficial vasculature of the body in-vivo.[9–13] Varanovskii used this technique to study the superficial veins of the female breast, highlighting that the superficial network drains in cranio-caudal and lateral directions.[14] Developments in infrared photography have enabled significant advances in the visualization of the venous structures of the breast. McWhorter (1987) demonstrated the use of colour filters and optical lenses to highlight the venous anatomy of the breast.[15] Less widely employed techniques for in-vivo imaging of superficial veins have also been described, including near-infrared photography,[16] multi-spectral stereoscopy,[17] and television infrascopy.[18]

These previous studies have largely demonstrated the superficial veins of the anterior surface of the breast (i.e. the upper pole). Utilizing modifications to infrared photographic technology, we describe the superficial veins of the entire breast, with an emphasis on the lower pole (inferior) of the breast, which only becomes detectable with the patient supine, and has been neglected in these previous studies.

Methods

A cohort of 32 otherwise healthy, voluntary participants were recruited. This comprised 26 females and 6 males. Exclusion criteria comprised breasts greater than cup size DD, overly ptotic breasts, previous breast surgery or radiotherapy or obstructive skin conditions or marks such as tattoos. Voluntary consent was obtained prospectively, and institutional ethical approval was obtained.

All photography was undertaken with a Pentax Digital S.L.R. (single lens reflex) 18—80 mm lens (Pentax Imaging Company, Golden, Colorado, USA). Modifications to traditional infrared photography included the use of a Hoya Infrared R.72 filter (Hoya Filter, Tokyo, Japan), only allowing the transmission of infrared rays above 720 nm, and post-processing with 'Photoshop Elements' (Adobe Elements 7, Adobe Systems Incorporated, San Jose, California, USA) to convert the images to monochrome and 'push' the images to highlight contrast boundaries.

The participants were photographed by a clinical photographer, with natural light boosted with an overhead spot-light and flash. Two views were taken in all cases: a frontal view was taken with the patient standing and a worm's eye (inferior) view with the patient lying supine.

Results

The use of infrared photography was able to clearly demonstrate the superficial veins of the breast in all participants, in both erect and supine positioning (see Figures 1—4). In all cases, the subareolar plexus of veins was clearly demonstrated, and the pattern of venous radiation from this plexus was evident. Although there were factors that affected image quality, the gross anatomy was distinguishable in all cases. These factors included male sex

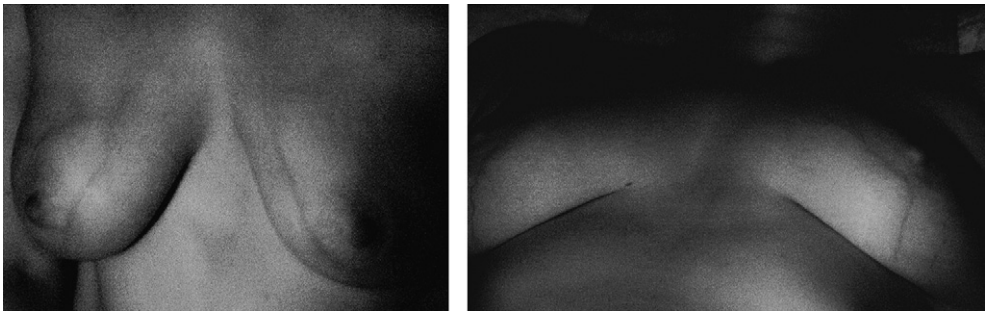

Figure 1 Case 1, demonstrating the superficial veins of the breast radiating superomedially on frontal view (left), and the inferior pole veins radiating along the breast meridian to the inframammary fold (right).