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Exploring the myth of the valveless internal mammary vein – a cadaveric study☆

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Summary Over the last thirty years the internal mammary system has become the recipient of choice when performing free tissue transfer breast reconstruction.[1–5] The cranial ends of the internal mammary artery and vein are safely and reliably used for anastomosis following division. Using these cranial vessels maintains their normal antegrade direction of flow.

As the complexity of reconstruction has increased, use of the caudal end of the internal mammary vein (IMV) has been cited as a convenient option for additional venous drainage.[6,7] This requires blood flow in a retrograde fashion. The literature to date suggests that this is possible based on the principle that there are no valves in the internal mammary vein.[8–10] This will be shown to be incorrect.

In this study, the internal mammary veins of 32 formalin-preserved cadavers were dissected to specifically look for and to map valves.

21 valves were discovered in the internal mammary veins of 14 of the 32 cadavers (99 internal mammary veins and major branches). 20 of these were bicuspid in nature, one being tricuspid. Valves were found before or after the branching point of the IMVs, and at multiple sites within some individuals. The significance of valve position relative to rib-space and arborisation of parent IMVs is discussed.

Whereas existing data support the use of retrograde IMVs to provide a source of additional venous drainage, we would urge caution in using them exclusively. A proportion of IMVs appear to have valves between the commonly used 2nd or 3rd rib-spaces, and the next draining side-branch.

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Introduction

The internal mammary artery and vein (IMV) have been used as recipient vessels for breast reconstruction over 30 years.[1–5,8] In addition to their favourable caliber match, relatively predictable anatomy, resistance to atherosclerosis and protection from the injury or scarring of previous surgery, they are also well positioned to allow medialisation of the breast reconstruction and ease of access for both operator and assistant under the microscope. Avoiding the thoracodorsal vessels preserves the latissimus dorsi flap as a salvage option. It has also been postulated that negative intrathoracic pressure generated during the respiratory cycle may support venous drainage from flaps where the IMV is used.

It is safe to use the antegrade limb of the IMV, but there are situations where additional use of the retrograde limb would be advantageous. For example, when using stacked flaps, or bipedicled flaps, or where additional venous drainage *via* the superficial inferior epigastric vein (SIEV) or an additional DIEP comitans vein is required. As the internal mammary vessels are already exposed, use of the retrograde limb enables additional venous drainage without further dissection and scarring arising from the use of subscapular axis vessels, cephalic vein or external jugular vein, options which may also require vein grafts.

Whereas previous anatomical studies have described the IMV in terms of position and branching patterns, none of them has specifically looked for valves.[8–10] Indeed techniques used for preparation of IMVs in some of these studies would have precluded the search for valves. Nevertheless, on the basis of these previous studies, it has been assumed that the internal mammary vein has no valves and hence that the retrograde limb of the vein can safely be used for anastomosis.[6,7,11,12]

Indeed, recent clinical studies have demonstrated venous flow when the retrograde IMV is used in addition to antegrade IMV drainage.[6,12] Further to this, IMV flow has been demonstrated in a porcine model where the retrograde IMV was used exclusively for venous drainage of LD flaps.[7]

Following observation of valve-like structures within the IMV clinically, the authors investigated further with cadaver dissections. It was postulated that IMVs did contain valves, and if found, that these should be mapped in relation to branching patterns and rib-spaces in an attempt to quantify the risk of an unfavourable outcome resulting from the use of retrograde IMVs.

Method

The chest plates of 32 formaldehyde-preserved cadavers were removed. Bilaterally, the IMVs were dissected from the parietal pleura and transversus thoracis muscles (Figure 1). Branching patterns were carefully recorded, concentrating on interspaces 1–6. None had received previous thoracic surgery.

The IMVs were carefully incised and residual thrombus was washed out (Figure 2). Further gentle irrigation in a retrograde direction was used to identify valve leaflets. Care was taken to distinguish between the leaflets of valves and those found at the ostia of side-branches. Valves were also photographed and valve position was recorded in relation to the ribs, and IMV branching pattern.

Figure 1 Internal mammary vessels dissected from thoracic wall.

As it is most common to access the IMVs with a rib-sparing approach *via* the 2nd or 3rd rib-space, each specimen was reviewed to assess the chances of finding a valve between the point at which a retrograde venous anastomosis would likely be performed, and the next side-branch, at each level.

Results

Of the 32 cadavers examined, 14 were male and 18 were female. A total of 99 veins and major branches were examined, as 88% of IMVs split into 2 veins. IMVs were noted to receive multiple branches from the sternum and intercostals. 19 anterior communicating vessels were recorded between venae commitantes. Medial branches

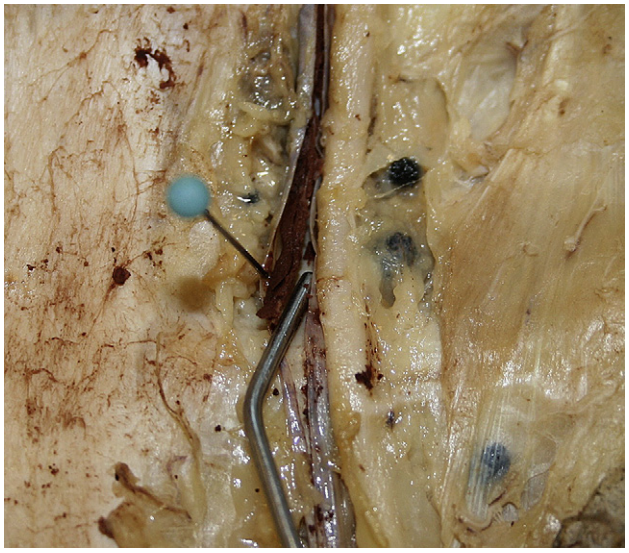

Figure 2 IMVs opened and thrombus carefully cleared away by irrigation and gentle probing.