Distribution of Valves in the Great Saphenous Vein; Its Clinical Implications

By

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Summary: The number and distribution of valves were examined in 26 great saphenous veins. The number of valves per vein ranged from 3 to 11 with an average of 6.7. The valves tended to be concentrated in two segments; one within 10 cm from the sapheno-femoral junction, and the other between 35 cm and 45 cm from the sapheno-femoral junction. More than 55% of the valves were located in these two segments. This fact should be taken into account when obtaining vein segments in graft operations.

The great saphenous vein is the most widely used vessel in graft operations for occluded arteries. It is employed in bypass constructions of the coronary, femoral and brachial arteries (Flemina et al., 1972; Leather et al., 1981). However, the presence of valves in the vein demands special operational procedures; some surgeons carried out so-called reverse graft, whereas others perform valvotomy with valve-cut devices (Donovan and Lowe, 1985; Baston and Sottiurai, 1985). Regardless of which procedure might be adopted, it is advantageous for surgeons to obtain valve-less veins. It is imperative, therefore, to know the valve distribution in the vein from which grafts are sampled. Despite this clinical necessity, the distribution of valves in the great saphenous vein has not yet been intensively examined, and there are only a few reports in the literatures (Hasse and Schaack, 1911; Kampmeier and Birch, 1927; Basmajian, 1952; Takeuchi and Suma, 1981). The present study was performed to clarify the number and distribution of valves in the great saphenous vein from the malleolar level to the sapheno-femoral junction.

Materials and Methods

Twenty-six great saphenous veins were examined in 20 cadavers age 38-95 years during the academic year of 1989. Students were asked to identify the great saphenous vein according to the description given in Grant's method of anatomy (Basmajian, 1980). They were also asked to indicate the level of the upper margin of the patella, ligating the vein with a colored silk string. The anatomy staff evaluated the students’ identification and ligation, and collected the veins. The whole length of the vein was cut longitudinally and the lumen was exposed. The number and location of valves were examined with the unaided eye and under a dissecting microscope, and the results were recorded. Although venous flow is directed from the medial malleolus to the sapheno-femoral junction (SFJ), the location of the valves was given as the distance from the SFJ.

Results

The results obtained are summarized in Figure 1. There were 174 valves in the 26 great saphenous veins. The number of valves per vein ranged from 3 to 11 with an average of 6.7. There were 111 valves (63.8%) between the SFJ and the upper patellar margin, and the remaining 63 valves (36.2%) were located between the upper patellar margin and the medial malleolus. A valve was consistently present in the SFJ (Figs.
Fig. 1. Distribution and numbers of valves in 26 saphenous veins. Dots indicate valves, single bars (—) indicate the levels of the upper patellar margin, and double bars (=) indicate the malleolar levels. The graph on the right shows the total numbers of valves in each 5 cm segment, e.g. the total number of valves in segment 0–5 is 49. Note that the highest peak is within 5 cm, and the second peak is situated between 40 cm and 45 cm.

1 and 2), and 49 valves (28.2%) were observed within 5 cm of the SFJ. It was found that 66 valves (37.9%) were located within 10 cm of the SFJ. It was also worthy of note that there were 31 valves (17.8%) in the venous segment between 35 cm and 45 cm from the SFJ. In 19 out of the 26 great saphenous veins, the upper patellar margin was situated in the segment of 30–35 cm. The number of valves in this segment was 8, and was as small as approximately two thirds of those of the adjacent segments at 25-30 cm and 35–40 cm.

Discussion

In non-reversed vein grafting valves should be mechanically cut. In reversed vein grafting, valves may produce turbulent flow and thrombosis. Thus, in either method of grafting, it is necessary to know the number and location of valves in order to ensure adequate operational procedures and postoperative management. Kampmeier and Birch (1927) examined 32 great saphenous veins obtained from 24 subjects. Although they did not mention it specifically, their results show that a segment at 10–20 cm from the SFJ had a very small number of valves. Similar results have been reported by Takeuchi and Suma (1981). The authors therefore searched for valve-free segments in the great saphenous vein. Our results supported the above observations. In particular, the finding that the segment at 10-20 cm was valve-free in 12 out of the 26 veins examined suggests a great utility for this segment.

Our data indicated that the valves tended to be concentrated in two segments; one within 10 cm of the SFJ, and the other at between 35 cm and 45 cm from the SFJ. The meaning of these results is clear. The great saphenous vein has especially many valves in segments just caudal to the hip joint and knee joint. Naturally, the function of the valves is to prevent venous blood from regurgitating. Blood stasis and regurgitation may readily occur according to flexion of the leg, and the presence of valves caudal to the joints is relevant. It was interesting to note that valves were extremely fewer at the level of the patella or knee joint. This may suggest that valves are not necessary or could even be harmful, when blood stasis persists, in venous segments at the level of the knee joint.

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