A Feasibility Study Comparing Histological Damage in Long Saphenous Vein Harvesting Using Endoscopic Vessel Harvesting During the Learning Curve Period.

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Background

Graft damage may cause intimal hyperplasia, narrowing of lumen and thrombus formation (1). Surgical trauma from harvesting, distension and handling, contributes to muscle migration and intimal thickening(2). This study compares structural damage to saphenous veins harvested by trainees during the Endoscopic Vessel Harvesting (EVH) (Figure 1) learning curve with structured training vs. conventional training.

Methods

Two hospitals participated, with two trainees at each site. Trainees T 1 and T2 underwent Structured Training (ST), while T3 and T4 received Conventional Training (CT). A target of 20 patients per trainee (n=80) was planned post-training. The ST trainees received full training from an experienced harvester using Manchester Endoscopic Learning Tool (MELT) (Figure 2), while the CT trainees were trained by a commercial proctor.

Vein samples (1 cm) were collected from the proximal (n=46), distal(n=46) region (both sections remained undistended), and a random sample (underwent surgical trauma, cardioplegia with 70 mls flow/distention, n=46).

Haematoxylin & Eosin (H&E, n=138) stained samples were used to assess endothelial preservation, Mason Trichrome (n=138) evaluated the longitudinal muscle layer (muscle migration both internally and externally, hypertrophy, and detachment), and CD34 (n=138) assessed endothelial viability. Samples were blindly scored by three independent researchers and a histopathologist. Due to insufficient CT data, no comparative analysis was performed. Descriptive statistical analysis (median [IQR]) was calculated.

Results

Four trainees (two male, two female) were enrolled. Post-training, T3 (CT) completed 1 case, and T4 (CT) completed 5 cases before withdrawing due to anxiety. Both ST trainees (T1 and T2) recruited 20 cases each during learning curve period.

Histological analysis showed variability across groups. For H&E staining (H1), median values were 0.9 (T3), 1.0 [0.9, 1.1] (T4), 0.7 [0.3, 1.1] (T1), and 0.8 [0.6, 1.1] (T2). For H2, T4, T1, and T2 groups had medians of 1.1 [0.9, 1.2], 1.1 [0.9, 1.1], and 0.9 [0.8, 1.2], respectively. H3 scores were 1.6 (T3), 1.2 [0.9, 1.2] (T4), 0.6 [0.3, 0.9] (T1), and 0.8 [0.6, 1.1] (T2). (Figure 3a,b,c,d)

Longitudinal Muscle (LM) migration and hypertrophy were higher in T4 (external: 0.3 [0.3, 0.5] for H1) and T1 (internal migration: 1.1 [1.0, 1.3]). (Figure 4a,b,c)

Longitudinal muscle detachment scores varied: (Figure 5a,b)

- H1: T1=0.0 (0.0, 0.3), T2=0.0 (0.0, 0.5) T3=0.3, T4=0.3 (0.3, 0.5)
- H2: T1=0.4 (0.3, 0.8), T2=0.0 (0.0, 0.8), T4=0.6 (0.3, 0.9)
- H3: T1=0.0 (0.0, 0.3), T2=0.0 (0.0, 0.3), T3=1.3, T4=0.5 (0.3, 0.5)

Endothelial integrity was higher in ST trainees (T1: 97.5 [95.9, 98.6], T2: 97.5 [93.5, 98.8]) compared to CT trainees (T3: 75.0, T4: 85.0 [85.0, 90.5]).

Conclusion

The COVID-19 pandemic halted the study. The study revealed varied histological differences in vein grafts harvested during the EVH learning curve. ST trainees exhibited better endothelial integrity and less hypertrophy and migration than CT trainees, though data interpretation is limited.

References:

1. Krishnamoorthy, B., et al., *A comprehensive review on learning curve associated problems in endoscopic vein harvesting and the requirement for a standardised training programme.* J Cardiothorac Surg, 2016. 11: p. 45.
1. Kay M, Abouelela Y, Raaj S, Krishnamoorthy B. Does the experience of the endoscopic vein harvester matter to the quality of the vein conduit: A critical thematic literature review. J Perioper Pract. 2025 May;35(5):171-182.

Figure 1: Illustrates 2cm scar from Endoscopic Vein Harvesting

Figure 3a: H&E-stained cross section of the LSV with valves, black arrow indicates mild stretching near valve area

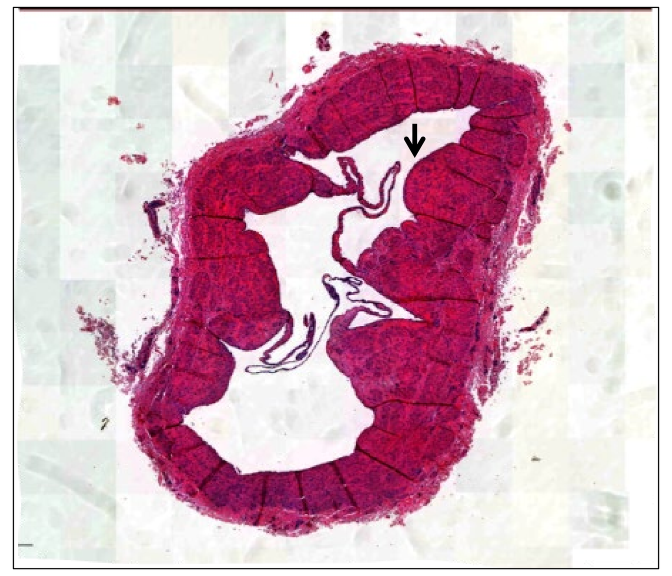


Figure 3b: H&E-stained cross section of the LSV(H3), black arrow indicates moderate stretching and detachment

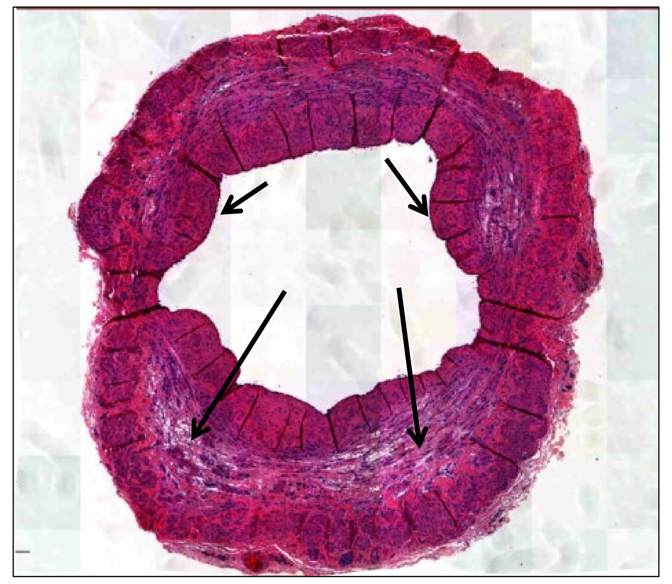


Figure 3c: H&E-stained cross section of the LSV (H1), black arrow indicates severe stretching and detachment

Figure 3d: H&E-stained cross section of the LSV (H1), black arrow indicates severe stretching and detachment/rupture

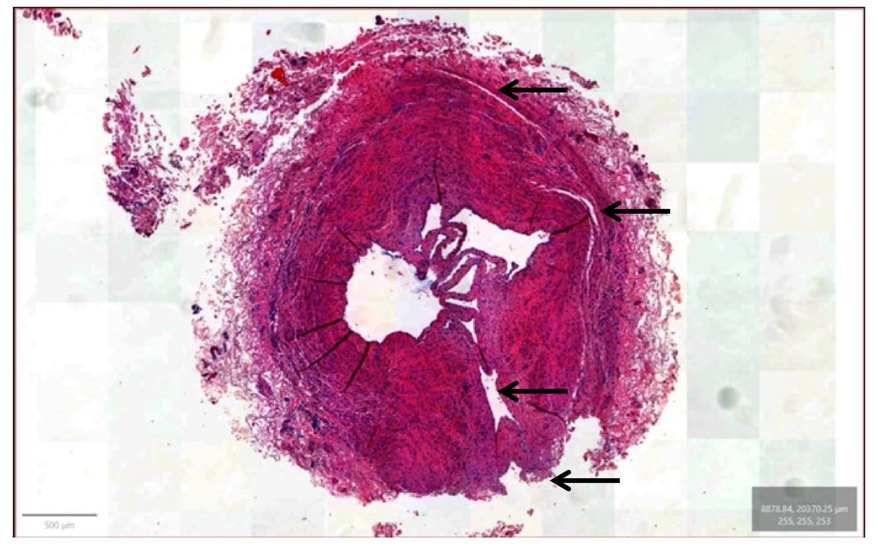


Figure 4a: Masson Trichrome-stained cross section of the LSV(H3), black arrow indicates mild hypertrophy and detachment of longitudinal muscle

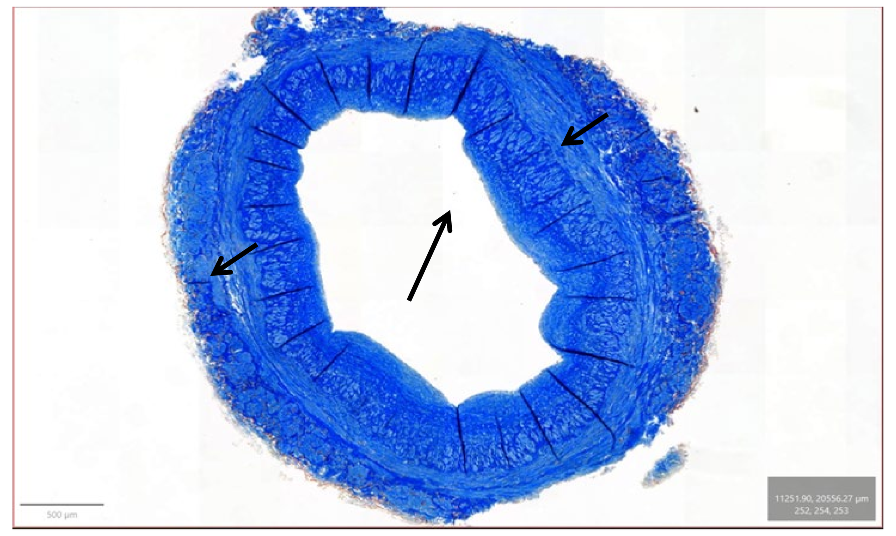


Figure 4b: Masson Trichrome-stained cross section of the LSV(H1), black arrow indicates moderate hypertrophy of longitudinal muscle

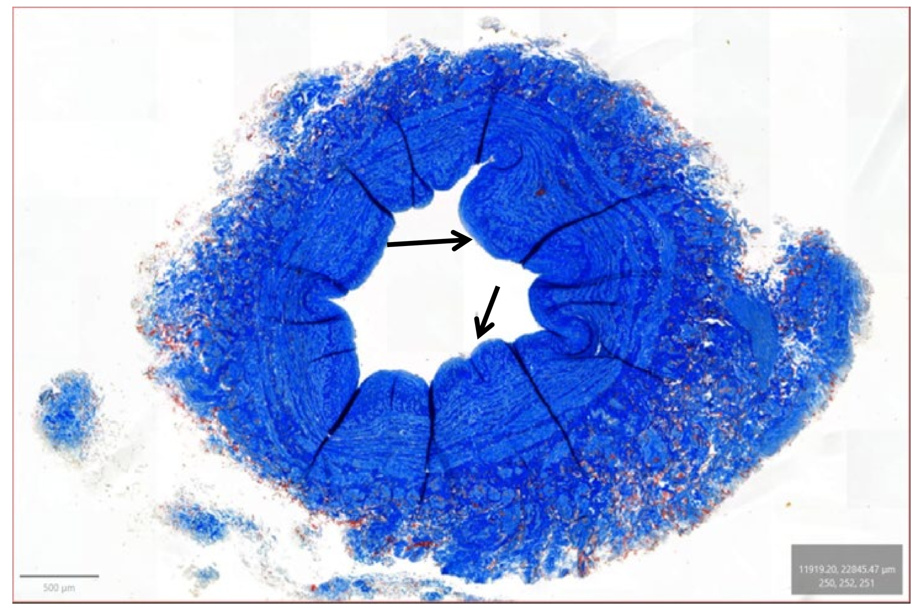
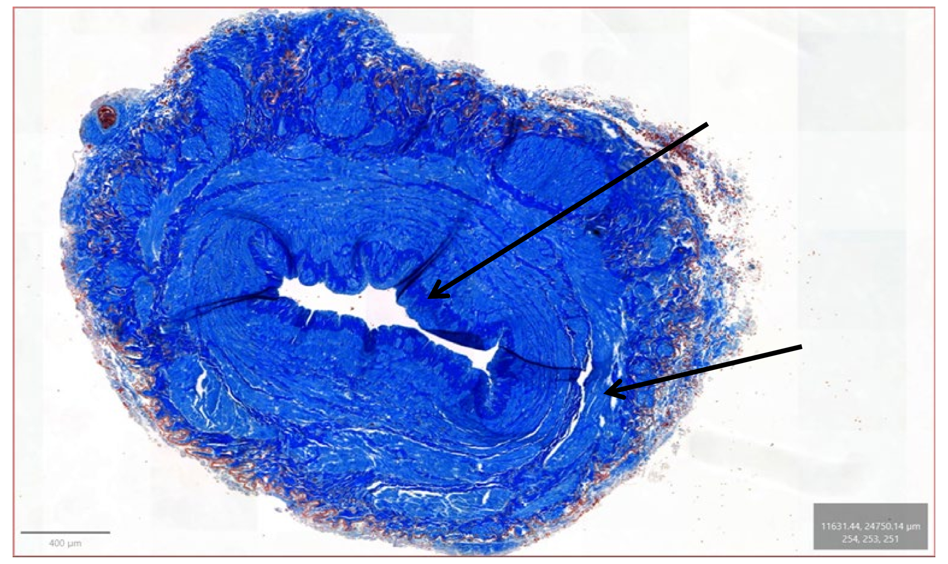


Figure 4c: Masson Trichrome-stained cross section of the LSV(H1), black arrow indicates severe hypertrophy and moderate detachment of longitudinal muscle



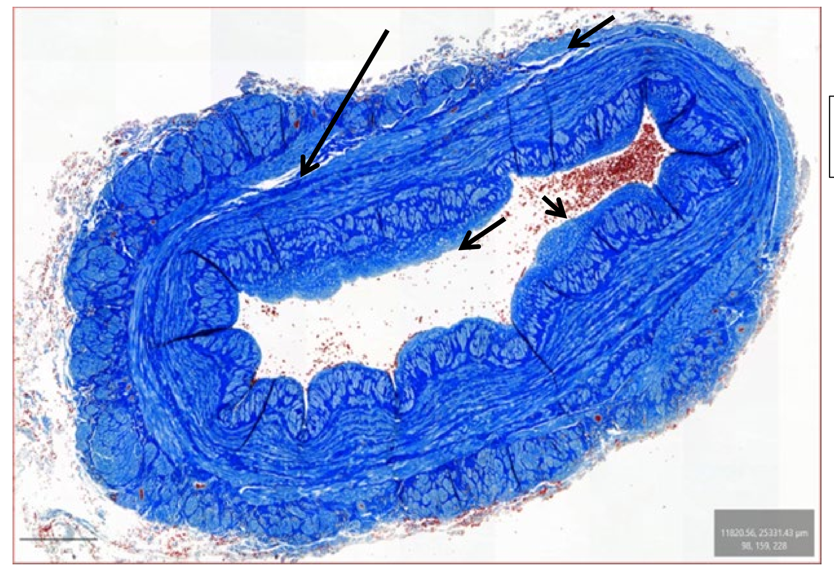


Figure 5a: Masson Trichrome-stained cross section of the LSV(H3), black arrow indicates moderate stretching and detachment

Figure 5b: Masson Trichrome-stained cross section of the LSV(H1) with side branch, black arrow indicates moderate detachment

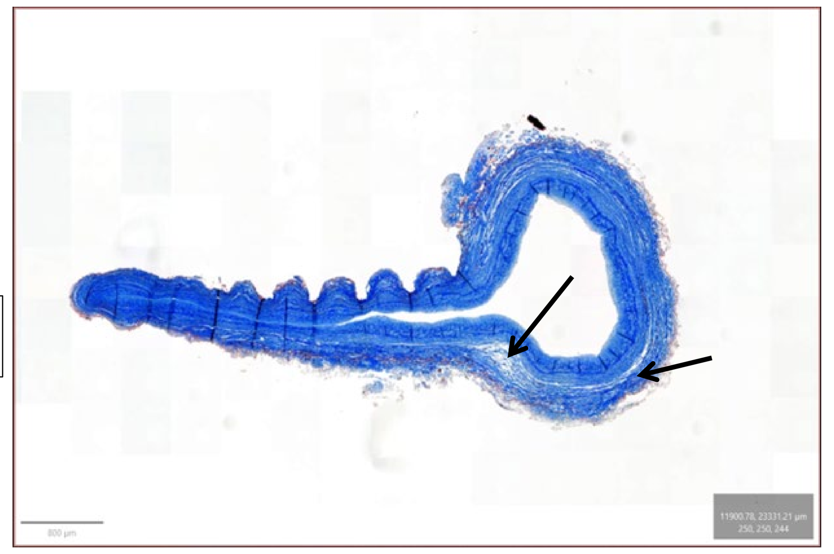


Figure 2: Illustrates the structure of the MELT training tool