

Variations of Upper Extremity Lymphatic Drainage: An Analysis of the Upper Arm’s Four Main Pathways

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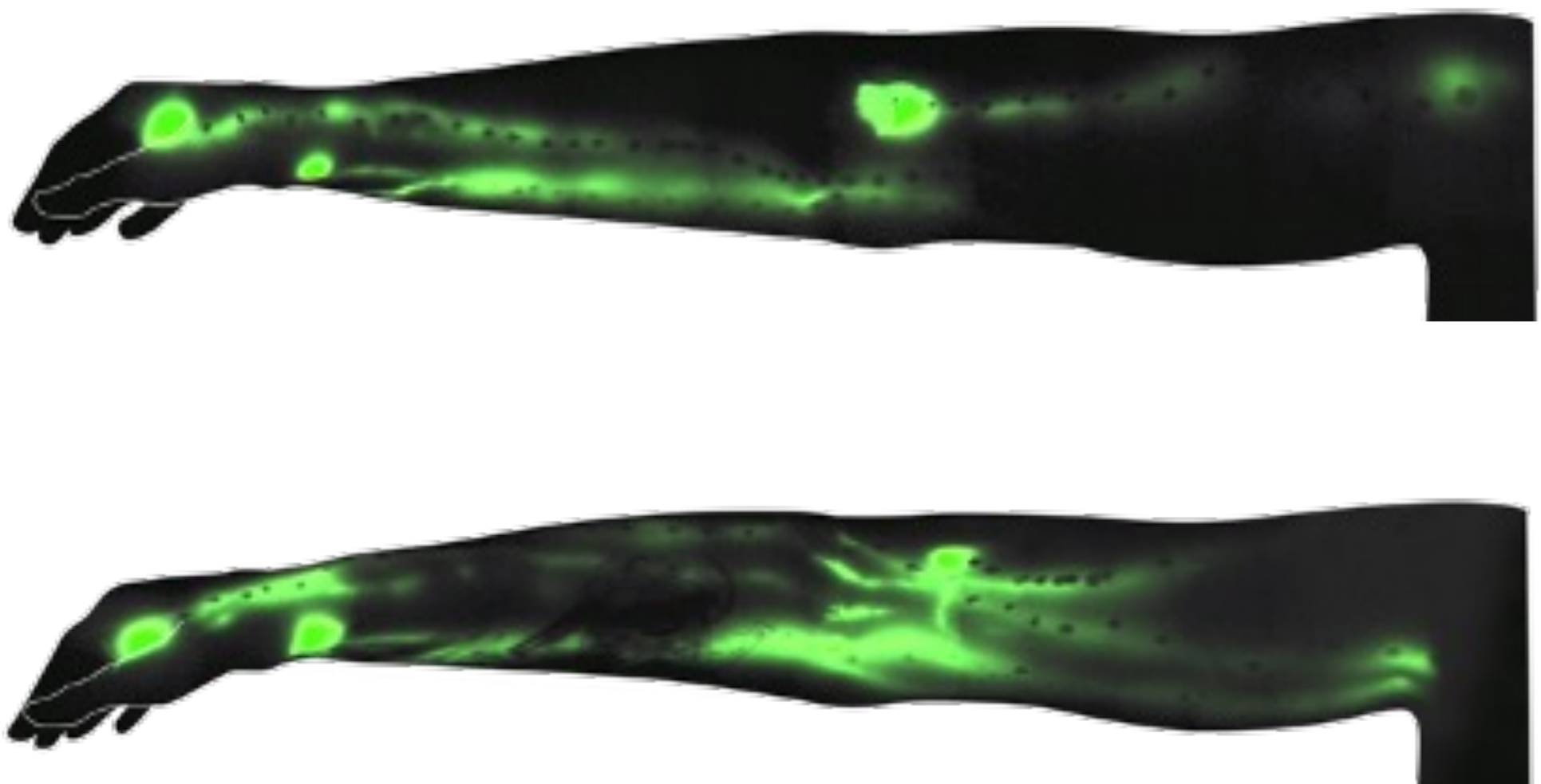
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Background

- Variations of upper extremity lymphatic anatomy may explain an individual’s predisposition for developing breast cancer-related lymphedema (BCRL) after axillary lymph node dissection (ALND)
- The lateral upper arm pathway and tricipital pathway are hypothesized to be protective drainage routes in the upper arm that avoid drainage to the axilla, while the bicipital and medial pathways of the upper arm are considered the arm’s main lymphatic drainage routes to the axilla
- Variable connectivity of lymphatic pathways in the forearm to the upper arm represents that only some patients can route lymphatic drainage to pathways avoiding axillary regions subject to ALND
- We describe population-level variations of anatomy in the upper arm’s four main lymphatic pathways

Methods

- 143 female breast cancer patients underwent ICG lymphography of the affected upper extremity prior to axillary lymph node dissection (ALND) and immediate lymphatic reconstruction (ILR)
- ICG patterns of the medial and bicipital pathways in the upper arm were recorded as present (**B or M**) or absent (B or M)
- ICG patterns of the lateral upper arm and tricipital pathways in the upper arm were recorded as present as a short-bundle (present in upper arm only) (**I or t**) or long-bundle (present in forearm and upper arm) (**L or T**), or absent (L or T)



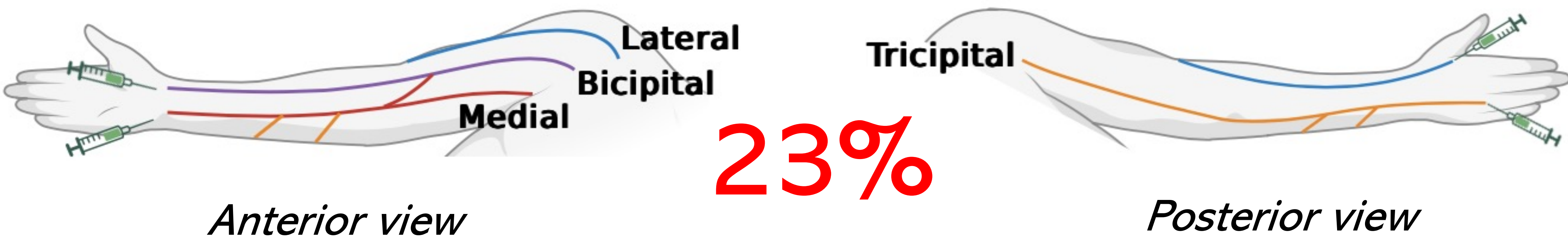
Short-bundle (top row) and long-bundle (bottom row) of the lateral upper arm pathway visualized with ICG lymphography

Results

Table 1. Eighteen (18) variations of upper arm lymphatic anatomy were visualized on ICG

Phenotype	L T	L t	I T	I t	<u>L</u> T	<u>L</u> t	L <u>T</u>	I <u>T</u>	<u>L</u> <u>T</u>	Total
B M	23%	21%	10%	4%	3%	3%	6%	4%	1%	75%
<u>B</u> M	8%	3%		1%			2%	1%		15%
B <u>M</u>	2%	2%	4%				2%			10%
Total	33%	26%	14%	5%	3%	4%	10%	5%	1%	100%

Figure 1. The most common variation of upper arm lymphatic anatomy



Discussion and Conclusion

- Only 23% of patients demonstrate drainage from the forearm to all four pathways
- Only 33% of patients demonstrate drainage from the forearm to both the lateral upper arm pathway and tricipital pathway
- Future investigation of lymphatic anatomy may help predict BCRL risk after ALND