Abstract

Purpose: Traditional descriptions of lymphatic drainage show eyelids emptying into the submandibular or preauricular basin. However recent studies based on in vivo lymphatic imaging show a possible predilection for the preauricular basin. We describe lymphoscintigraphy and report findings in patients with eyelid malignancies undergoing sentinel lymph node biopsy (SLNB).

Methods: Retrospective chart review of 15 consecutive patients at a single institution with eyelid carcinoma undergoing SLNB. The primary outcome measure was primary facial lymphatic drainage site from the eyelid as determined by lymphoscintigraphy.

Results: The preauricular basin was the site of focal radioactive uptake in all 15 patients. The location of the primary tumor was as follows: medial upper eyelid (1), medial canthus (3), medial lower eyelid (3), lateral upper eyelid (3), and lateral lower eyelid (5). The types of tumor were: invasive squamous cell carcinoma (7), malignant melanoma (3), and sebaceous cell carcinoma (2), Merkel cell carcinoma (2), and conjunctival spindle cell carcinoma (1).

Conclusions: Lymphoscintigraphy is increasingly used in the context of SLNB for periocular malignancy. The recent literature suggests that the preauricular lymph node basin may be the primary site of eyelid lymphatic drainage and this is corroborated by our series. Further data will elucidate the biology of eyelid lymphatic channels in humans but the preauricular basin may be the prime lymphatic metastatic site in eyelid malignancies.

Keywords: Sentinel lymph node biopsy, Sentinel lymph node, Eyelid malignancy, Eyelid lymphatics, Lymphoscintigraphy

Introduction

Understanding lymphatic drainage of the eyelids is important for several reasons. Chiefly, eyelid malignancies may first travel to the lymphatics and the draining areas, the sentinel node may be the site of primary metastasis. Additionally, knowledge of these pathways is important in facial surgery planning since traversing may lead to problematic lymphedema.

Traditional descriptions of lymphatic eyelid drainage suggest that the lateral eyelids drain to the preauricular nodes, while the medial portions of the eyelids drain to the submandibular nodes. This understanding of the lymphatic drainage patterns of the eyelids derives from dye studies conducted several decades ago. Other knowledge to date has been extrapolated from investigations conducted postmortem or in animal models.

Sentinel lymph node biopsy (SLNB) is gaining significant use in staging periocular carcinoma.

A sentinel lymph node is often the first site of malignant tumor spread before dissemination to more distant sites, and a SLNB is performed for histopathologic examination to determine the presence of microscopic metastasis. Unlike a lymph node dissection that traditionally involves removing a bulk of tissue with 10–15 lymph nodes, SLNB is less invasive and usually involves the biopsy of one or two lymph nodes.

The spread of tumor to sentinel nodes can carry prognostic implications. A SLNB may identify regional metastases otherwise undetected on imaging or clinical examination. Additionally, positive sentinel lymph node may also upstage...
a tumor. Chemotherapy, radiation, or further surgery may be indicated based on the status of the sentinel lymph node.

Pre-operative imaging is an important feature of modern SLNB techniques. In advance of surgical excision, technetium-99m sulfur colloid is injected subcutaneously around the malignancy to identify the sentinel node to generate a lymphoscintigraphy image (Fig. 1). (Intraoperative maneuvers including subcutaneous injection of isosulfan blue and technetium-99m with transcutaneous gamma probe further add to identification of the sentinel node.) With the increasing use of SLNB, the database for in vivo and in situ drainage pathways from the pericocular region is increasing.

The recent literature suggests a predilection to the preauricular basin for all regions of the eyelid and challenge classic anatomical descriptions.\(^5,6\) We evaluate lymphoscintigraphy results in patients with eyelid malignancies undergoing sentinel lymph node biopsy (SLNB).

### Methods

With Institutional Review Board (IRB) approval, we retrospectively reviewed the charts of 15 patients with carcinoma of the eyelid who also underwent SLNB. The primary outcome measure was the sentinel node location as determined by lymphoscintigraphy. We also assess the location of the primary tumor (hence technetium injection site).

The sentinel lymph node was identified with preoperative lymphoscintigraphy using a technetium (Tc99m)-labeled sulfur colloid injected around the primary lesion, and a gamma scintillation camera to identify the site of focal radioactive uptake. Perioperative technetium-99m and intraoperative isosulfan blue injection with the aid of a transcutaneous gamma probe were also used to mark the sentinel lymph node that was resected and sent for histopathologic analysis.\(^6\) Fig. 1 depicts a typical lymphoscintigraphy image after eyelid injection of technetium (Tc99m)-labeled sulfur colloid with enhancement at the parotid nodes.

### Results

In all cases, clinical assessment was negative for evidence of regional lymph node involvement and imaging was negative for distant metastases. Thus, prior to SLNB, staging was N0 for all patients.

In all patients, the preauricular node was identified as the sentinel node by preoperative lymphoscintigraphy with technetium. This was confirmed with intraoperative detection of radioactivity with technetium, and intraoperative gross visualization with isosulfan blue. Table 1 profiles each patient’s course, detailing the primary tumor’s anatomic site and the type of malignancy.

In 7 patients (47%), the preauricular drainage was not predicted based on the tumor location. In the remaining 8 patients, preauricular uptake followed predicted pathways.

### Discussion

The SLNB procedure is increasingly employed in the management of cancer.\(^7\) The SLNB technique, including lymphoscintigraphy, also allows for specific, in situ and in vivo, studies of lymphatic drainage patterns.

The use of SLNB in oculofacial cancer provides new data that may enhance our current understanding of lymphatic drainage of human eyelids.\(^5,6\) The classical understanding of eyelid lymphatic drainage—the lateral portions of the upper and lower eyelids drain to the preauricular nodes, while the medial portions of the upper and lower eyelids were thought to drain to the submandibular nodes — has been contested for decades.\(^1\) These drainage patterns were derived from vital dye injections and microscopic evaluations of histological sections.\(^2,3\)

Nijhawan et al. described the drainage pattern using SLNB in non-oncologic scenarios and found that 18/25 patients undergoing eyelid surgery had a SLN at preauricular basin, regardless of the location of technetium injection.\(^5\) Several other studies, corroborate a predilection of the preauricular lymph node basin in SLNB of eyelid malignancies.\(^6\) This predilection may also be seen in cynomolgus monkeys.\(^5\) Our series involving various eyelid malignancies also agree with these findings.

In our study, 100% of patients had radioactive uptake parotid basin, regardless of the location of the eyelid technetium injection site. In 8 of these patients (53%) with lateral eyelid tumors, these findings were expected. Yet, in

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<tr>
<th>Patient</th>
<th>Tumor type</th>
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<td>Patient 1</td>
<td>SCC</td>
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<td>Patient 15</td>
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the other 7 patients (47%) the medial primary tumor location may have predicted a submandibular route with classic lymphatic anatomy descriptions. These findings in consecutive patients suggest more than anomalous lymphatic drainage. These cases may add to the growing body of knowledge of the human lymph pathways.

Sentinel lymph node biopsy has proven useful in the clinical staging of several types of cancer. SLNB and associated imaging are further offering new insights to the biology of eyelid lymphatic drainage. Further studies will help to clarify the complexities of eyelid lymphatics that may provide insight to metastatic spread of tumors. The preauricular zone may be an important site for potential lymphatic metastases with invasive periocular tumors.

References