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Wide Local Excision Depth of Primary Malignant Melanoma: Evidentiating Current Practice Utilising Patent Blue V Dye During SLNB

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Abstract

Whilst there is more or less an agreement on the peripheral margins that are to be excised with primary cutaneous melanoma, the depth of excision remains an area of uncertainty that prevails amongst some surgeons. This is irrespective of their specialty, and indeed this uncertainty is prevalent amongst physicians dealing with skin oncology. This in part may be due to historical studies, however, we present visual evidence negating the need for fascial excision, as shown in recent studies, which is proved by lack of sub-fascial dye permeation during wide local excision and sentinel lymph node biopsy (SLNB).

Keywords: *McKissock; Vertical bi-pedicle dermal flap; Wise-pattern; Letterman; Immediate reconstruction; Autologous reconstruction; Implant reconstruction; Synthetic absorbable TIGR mesh; Lateral chest wall perforator flap reconstruction; L-TAP; Li-CAP; Adipo-dermal flap.*

Introduction

Surgery remains the mainstay in the management of primary melanomas. Whilst there are now clear guidelines about the peripheral excision margins based on Breslow thickness [1], the depth of excision has remained a topic of contention.

More than a century ago William Handley formulated the initial guidelines on the excision margins of melanomas. He conducted an autopsy on a woman with metastatic malignant melanoma, paying particular attention to the inguinal lymph nodes. Handley found intra-lymphatic involvement deep to the fascia. Based on these findings, he recommended 1inch skin excision surrounding the tumor, with 2 inches of subcutaneous tissue including fascia and muscle. This study formed the basis of surgical management of malignant melanomas for the next 60 years [2].

Olsen et al. published their findings comparing local recurrence rates of malignant melanoma in patients who had fascia excised with the tumor, against those with fascia left intact. They found that leaving the fascia intact did not increase the risk of local recurrence and that removing the fascia may actually increase this risk. The lead authors work on the anatomy of cutaneous lymphatics revealed that the lymphatics of the skin commenced in the papillary dermis, and drained into supra-fascial subcutaneous lymphatic trunks, with occasional communication with sub-fascial lymphatic trunks. Blue dye injected intra-dermally only reached as far as the fascia, without breaching it [3]. The findings of Olsen have since been corroborated by several studies.

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Keneady et al. found no statistically significant difference in recurrence rates; site of recurrence; or overall survival in patients with stage 0 and 1 malignant melanoma of the trunk and limbs who either had excision of fascia, or preservation of fascia [4]. Similarly, Grotz et al. found that fascia preservation significantly reduces the risk of loco-regional recurrence (in-transit recurrence and nodal recurrence), whereas resection of fascia was highly associated with loco-regional recurrence [5].

Despite the evidence favoring preservation of fascia, there exists wide variation in practice. A recent study by Dermatologists in the United States revealed that the likelihood of fascial resection increased with Breslow thickness of the tumour [6].

Our study demonstrates, with the use of Patent Blue V (Guerbet - France) dye at the time of Sentinel node biopsy and wide local excision of the melanoma, that resection of deep fascia or beyond is unwarranted.

Methods

The site of the of the original melanoma is extrapolated on to the excisional biopsy scar. This site is then injected intradermally with up to 2 milliliters (ml) of Patent Blue V (Guerbet - France) dye prior to sentinel node biopsy and wide local excision of the scar. The peripheral margin is decided according to the Breslow's thickness [7], however the depth was limited to, and did not include the deep fascia. The depth of penetration of the dye was identified only above the deep fascia as is shown in our sample case [Figures 1-3].

Results

The following photographs [Figures 1-3] demonstrate the blue dye injected intra-dermally directly over the site of the original melanoma, within the biopsy scar, and it shows its infiltration into the subcutaneous tissue and reaching the deep fascia, but not penetrating it.

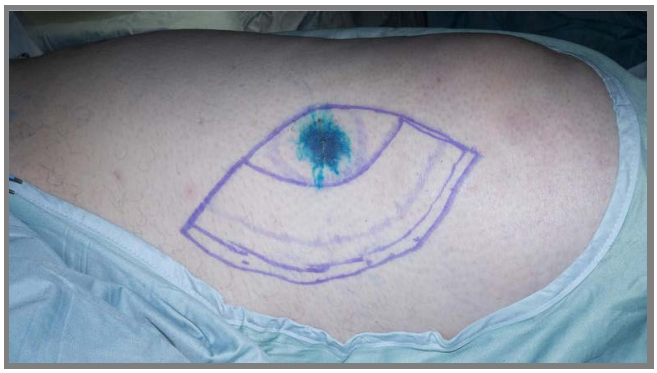

Figure 1: Patent Blue V dye injected intra-dermally at the site of previous melanoma excision, with keystone flap planned for reconstruction.

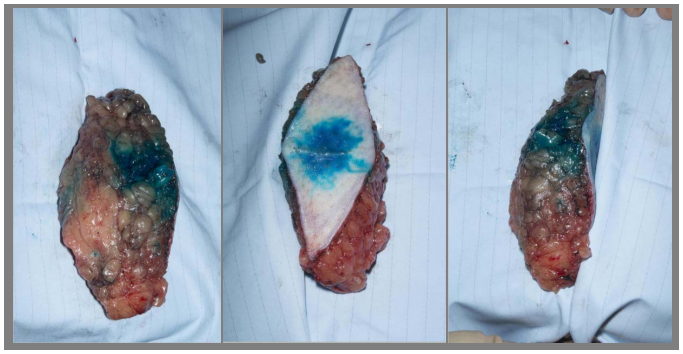

Figure 2: A; Superior view of 3cm wide local excision specimen. B; Lateral view of wide local excision specimen. It is evident here that the Patent Blue V dye permeates avidly through from the dermis into the subcutaneous tissue. C; Inferior view of wide local excision specimen.

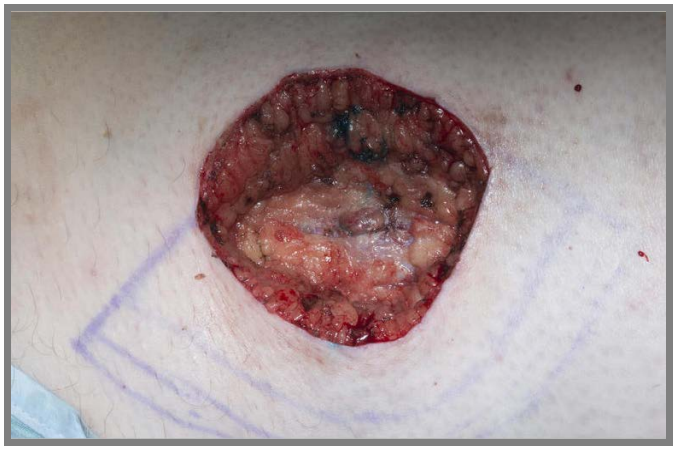

Figure 3: Defect left post-excision. The tissue has been excised down to deep fascia (green arrow). It is evident here that the blue dye has not breached this layer and remains within the subcutaneous adipose layer (blue arrow).

Discussion

The surgical management of malignant melanomas has changed in the last century. In the early part of the 20th century common practice was to excise the melanoma with a cuff of tissue extending beyond the deep fascia, including the muscle – in large part this was based on William Handley's study and recommendations [2]. The rationale was that an extensive excision will not only remove the primary tumour, but also any of the 'compromised' surrounding tissue, thereby reducing the risk of local recurrence.

However, since the 1960s the evidence failed to demonstrate the advantage of such approach. Olsen et.al presented their findings that further challenged the prevailing practice. They showed that in patients who had excision of fascia along with excision of tumour, the incidence of lymph node metastasis was higher as compared to those who had fascia left intact. It was also shown that leaving fascia intact did not increase the risk of local recurrence [3]. To investigate further they studied cutaneous lymphatics by injecting 0.1ml patent blue dye into the skin and found that the dye only went as deep as the fascia, but not through. It was known that the lymphatics of the skin began in the papillary dermis, and drained into subcutaneous lymphatic trunks, with occasional communication with deeper (sub-fascial lymphatic trunks). Based on these findings, it was theorized that the deep fascia acted as a valve system to regulate flow between the discrete lymphatic systems of supra-fascial and sub-fascial compartments. Thus, by excising fascia, the valvular regulatory system is effectively removed, thereby increasing the flow of malignant cells from the superficial compartment to the deep compartment [3].

Many others have validated Olsen's landmark findings. Keneady et al. compared the effects of fascial excision versus fascial preservation in patients with stage 0 and 1 malignant melanoma: there was no significant difference in recurrence rate, site of recurrence or overall survival in 107 patients who had fascia excision and 95 who did not [4]. More recently, Hunger et al. demonstrated that patients with melanomas of Breslow thickness greater than 2mm had no significant difference in disease-free survival, local recurrence, or loco-regional and distant metastases in patients who had fascia excised versus those had it preserved [8].

Olsen's theory of discrete lymphatic systems has also been corroborated by recent studies. In cadaveric analysis of the superficial lymphatics of the thigh, Tourani et al. demonstrated two discrete groups of lymphatic collectors: the ventromedial bundle, and the local collectors. The collectors of the ventromedial bundle were mainly found in proximity to the greater saphenous vein, either in the membranous layer of the superficial fascia, or just superficial to the deep fascia. These vessels were also thick-walled, measuring 0.6-1mm. In comparison, the local collectors which were more widespread, and could be found just deep to subdermal venules. These vessels were thin-walled (measuring 0.3-0.5mm), and transparent [9]. Their work highlighted that whilst there were morphological and topographical differences in the lymphatics of the superficial thigh, these collecting systems were separate from that of the deeper compartment of the thigh.

The arrangement of cutaneous lymphatics may confer more advantages than that postulated by Olsen. Looking briefly at the arrangement of subcutaneous adipose tissue, they are held in ligamentous fences, or 'retaining systems' that contain perforating arteries, as well as pre-collecting lymph vessels. Intra-dermal injection of Methylene blue travels as far deep as the deep fascia, but not beyond, because the particle size was too large to permit permeation. This arrangement would also aid in the isolation of infection and enhance antigen-presentation [10].

We have shown that intra-dermal injection of Patent Blue V (Guerbet - France) dye at the site of melanoma excision does not permeate beyond the deep fascia in concordance with the above studies. We were able to demonstrate the same findings in melanomas of Breslow's thickness greater than 1mm. The dye seemed to be confined to the sub-dermal adipose retaining systems. Taken together with the evidence discussed above, it shows that the superficial

cutaneous lymphatic system is indeed discrete to that of deeper lymphatic systems. This may perhaps be due to the deep fascia acting as a mechanical barrier, or due to the incompatibility of particle size of the dye and pores of the retaining system, or perhaps a combination of both. Regardless of the mechanism, the fact remains that cutaneous lymphatics effectively terminate above the deep fascia. Taken in the context of treatment of melanoma, both primary excision and wide local excision of melanoma scar, the depth can be limited to the deep fascia, without resecting it. As the superficial and deep lymphatic systems are separate, there is no additional risk of local recurrence when the deep fascia is preserved.

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