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Color Coding Surgical Margins with The Davidson Marking System

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Abstract

A commercial marking system, The Davidson Marking System, was used in our hospital to identify the surgical margins of excisional diagnostic biopsies. The colored dyes were easily applied and withstood both frozen section preparation and routine tissue processing. Unequivocal identification of the surgical margins facilitate complete excisions of a lesion and can identify the specific site of tumor margin involvement (The J Histotechnol, 13:293, 1990)

Key words: frozen section, surgical colored dyes, surgical margins

Introduction

The skin is the most common site of cancer and accounts for over 500,000 new cases in this country each year (1). Many of these easily accessible skin tumors can be surgically excised under local anesthesia in an outpatient setting. Ideally, this procedure should be performed in an area in which the pathologist and surgeon can freely communicate with each other about specimen orientation and surgical margins. In reality, because of time and economic constraints, a formalin fixed diagnostic biopsy is often performed in the surgeon's office and sent to the pathologist for interpretation. This protocol is effective if the pathologist can orient the specimen and advise the surgeon of potential tumor involvement of the surgical margins.

The authors have devised their own system that guarantees adequate identification of the surgical margins. The skin lesion is excised in the surgeon's office under local anesthesia. The specimen is marked or tagged in two places to orient the specimen. The anterior or posterior aspect of the specimen is marked with a suture; the superior or inferior margin is then marked with a permanent ink, such as India ink or two sutures (Figure 1). The specimen is submitted in the fixed or unfixed state to the pathologist. A diagram of the pertinent anatomy showing the location of the sutures and ink marking is useful for guaranteeing the orientation of the specimen.

Multiple colors allow identification of five surgical margins rather than just three, two short axis margins, the two long axis margins, and the deep margin. Evaluation of the five surgical margins can identify the specific site of an existing tumor and its probable extent beyond the surgical margin of resection for the attending surgeon. Re-excision of the involved margin can then be performed. The most commonly employed dyes used for the marking of a surgical margin have included merbromin (red), common laundry bluing (blue), and India ink (black), which were not designed specifically to withstand frozen section tissue processing or routine processing of tissue (2). No other commercial system is available. Recently, dyes specifically designed to withstand immersion in high concentrations of alcohol and xylene and to remain affixed to the tissue have been developed.

*The original margin marking system for a variety of applications
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Tissue dyes should be applied only to excised tissue as the tissue will be permanently stained. The dyes should not be used when hormone receptor assays are to be determined (3). The permanent stain will interfere with the receptor assays reaction and will cause false results.

Materials and Methods

The dyes are more effective when applied to unfixed tissue, but they work well when applied to tissue already fixed in formalin. Fixed tissue should be wiped gently to remove excess formalin. Fresh tissue should be patted dry.

The specimen was oriented, marked, and serially sectioned. We oriented the specimen so that the long axis margins were placed to the sides on the frozen section chuck and the serially sectioned short axis margins/deep surgical margins were placed in order in the center of the chuck. (Care must be used to orient the tissue so that the knife blade cuts the epithelial surface first the subcutaneous fat layer last.) A total of five tissue dyes, blue, red, black, green, and yellow (The Davidson Marking System, Bloomington, MN), were used to mark the margins (Figure 2). The two long axis margins were removed and colored with blue and black dyes. The two short axis margins were marked with colored ink; applicator sticks were used to allow a more thorough coating of the tissue surface. On larger specimens, a cotton tip swab was used to paint the inferior surface or deep surgical margin. The deep margin (commonly composed of adipose tissue) was marked with yellow dye and the contiguous short axis margins were marked with red and green dyes. The tissue was allowed to dry approximately 10 minutes to allow a chemical bonding of the dyes with the tissue. Only small amounts of dye are necessary for effective marking.

Two sections were taken, one at 2-4 μm , the other at 6-8 μm . Formalin fixed tissue was routinely processed. Unfixed tissue was submitted for immediate diagnosis.

Results

The orientation of the tissue was maintained and microscopic evaluation of the two short axis surgical margins, the two long axis surgical margins, and the deep surgical margin was achieved. When irregular surfaces were adequately painted with a cotton tipped swab, stick applicators were used for smooth surfaces, and the dyes were allowed to dry for approximately 10 minutes, all surgical margins become readily identifiable at the microscopic level (Figure 3). The yellow dye appeared to bond better with adipose tissue than the other dyes did.

Discussion

The taking of two histological sections, one thin, the other thick, has advantages in rendering a complete diagnosis. The thin section is used to evaluate the cellular morphology of the lesion. The thick section is used to evaluate the presence or absence of tumor involvement of the surgical margins. Letting the dyes bond to the tissue for approximately 10 minutes enhances the ability of the complex to withstand both frozen section and routine processing while maintaining the tissue-dye bonding. In the past, the dyes were too easily washed off during the routine tissue processing because they were not specifically designed for fixing to the tissue. However, the new dyes remain readily identifiable even after processing through both alcohol and xylene.

There is another interesting application for the dyes and that is the ability to process multiple surgical specimens; painting each specimen with a different dye makes them readily identifiable. This is an effective cost and time saving measure to increase efficiency in the laboratory. The response from the surgeons at our hospital has been very positive. Currently, there is a 5% reexcision rate, and the reexcision tissue is handled in the same manner as the original surgical specimen.

The Davidson Marking System is now being utilized in this laboratory for skin lesions, intra-oral, sinus, proximal respiratory tree, laryngeal, and vocal cord lesions.

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