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Research Article

Late-Onset Anaphylactic Reaction Induced by Patent Blue V During Sentinel Lymph Node Biopsy: A Rare Case Report and Brief Literature Review

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Abstract

Introduction: Patent Blue V is widely used for sentinel lymph node identification in breast cancer surgery but may cause severe adverse reactions such as anaphylaxis. Although rare, it represents a potentially life-threatening event requiring prompt recognition and management.

Methods: A narrative literature review was conducted using PubMed, SciELO, and DOAJ databases, including articles and case reports published between 2005 and 2024 addressing allergic reactions to Patent Blue V.

Case Report: A 70-year-old female patient with luminal A invasive carcinoma underwent a segmental mastectomy and sentinel lymph node biopsy (SLNB) after subdermal injection of 2 mL of 2.5% Patent Blue V. In the immediate postoperative period, she developed bluish urticaria, lip edema, and dyspnea without hemodynamic instability. The event was classified as grade II anaphylaxis (Ring and Messmer) and treated with intravenous epinephrine, diphenhydramine, and inhaled salbutamol, with complete resolution within a few hours.

Discussion: Anaphylaxis induced by Patent Blue V may occur through immunological mechanisms (IgE-dependent or independent) or direct mast cell activation. Diagnosis is clinical, and prophylaxis remains unvalidated. Systematic reviews suggest a lower risk when using intradermal administration and dye volumes below 2 mL.

Conclusion: Patent Blue V-induced anaphylaxis is rare but potentially severe. This case underscores the importance of continuous anesthetic and surgical vigilance and preparedness for immediate intervention.

Keywords: Patent Blue V; Anaphylaxis; Sentinel lymph node; Breast cancer.

INTRODUCTION

With the advancement of oncologic treatment, sentinel lymph node biopsy (SLNB) has become the standard procedure for surgical staging of early invasive breast cancer [1]. Identification of the sentinel lymph node can be achieved using either Patent Blue V dye or the technetium-based radiotracer, applied separately or in combination. The combination of both methods yields a sensitivity of approximately 98% for sentinel node detection [2]. However, Patent Blue V is associated with IgE-mediated hypersensitivity reactions, which may be severe and require hemodynamic support. These manifestations range from mild cutaneous reactions to anaphylaxis with significant cardiovascular compromise. With an estimated incidence between 1:350 and 1:20,000—more recent studies narrowing this to one case per 1,000 to 10,000 procedures [3]-it remains a rare adverse reaction but one that warrants particular attention due to its potential clinical impact, necessitating early recognition and prompt management.

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MATERIALS, SUBJECTS AND METHODS

To conduct this literature review on complications associated with the use of Patent Blue V, review articles and case reports addressing the topic were analyzed. The research was carried out in the DOAJ, PubMed, and SciELO databases. The following keywords were used: reaction; anaphylaxis; sentinel; Patent Blue — to identify articles published between 2004 and 2024 that aligned with the objectives of this review.

Inclusion criteria comprised studies addressing allergic reactions to Patent Blue V, published between 2004 and 2024, in English or Portuguese. Articles that did not directly discuss the use of the dye or presented inconclusive data were excluded.

CASE REPORT

A 70-year-old female patient was diagnosed with invasive carcinoma of no special type, luminal A subtype (cT1 cN0 cM0). She underwent upfront surgery consisting of a left breast segmentectomy guided by ultrasound and ipsilateral sentinel lymph node biopsy (SLNB). Balanced general anesthesia was performed with intravenous administration of midazolam 2 mg, fentanyl 200 mcg, lidocaine 50 mg, propofol 70 mg, and rocuronium 30 mg. Hydrocortisone 500 mg was administered prophylactically prior to the use of Patent Blue V.

Before the surgical incision, 2 mL of 2.5% Patent Blue V was injected into the periareolar subdermal tissue. The SLNB specimen was sent for intraoperative frozen section analysis, which revealed three lymph nodes free of malignancy. The procedure was uneventful, lasting a total of two hours.

Figure 1 Personal Archive – Anterior view showing diffuse maculopapular skin eruptions with bluish discoloration

After extubation, the patient developed upper lip edema and bluish urticarial plaques (Figures 1 and 2), accompanied by pruritus and decreased vesicular breath sounds on auscultation, while maintaining hemodynamic stability. Approximately fifteen minutes later, she developed dyspnea and worsening pruritus. The anesthesia team promptly intervened, administering intravenous epinephrine (25 mcg), diphenhydramine 50 mg IV, and salbutamol (4 puffs), resulting in improvement of respiratory pattern and regression of the lesions.

The patient remained under observation in the post-anesthesia care unit (PACU) with intravenous hydration and maintained hemodynamic stability without further complications. After two hours, no cutaneous alterations were observed, and she was discharged home the following day.

DISCUSSION:

After intradermal or intraparenchymal administration, Patent Blue is rapidly absorbed by the lymphatic vessels in the drainage area, where it binds to plasma albumin. Approximately two-thirds of the substance are absorbed within the first hour, with complete elimination occurring within 24 hours. Excretion takes place mainly through urine and bile [4].

Anaphylactic reactions related to Patent Blue are mediated by both immunologic and non-immunologic mechanisms. Immunologic reactions may involve IgE-dependent or IgE-independent pathways, whereas non-immunologic reactions result from direct mast cell activation. Regardless of the underlying mechanism, the clinical presentation results from mast cell and basophil degranulation, leading to the release of mediators such as histamine, tryptase, platelet-activating factor (PAF), and cysteinyl leukotrienes [5].

The first sign of dye-induced anaphylaxis is often a progressive drop in oxygen saturation, which may or may not be accompanied by cutaneous manifestations and arterial hypotension. Treatment must be initiated immediately, including administration of 100% oxygen, vigorous fluid resuscitation, and the use of corticosteroids and antihistamines. In severe cases, epinephrine administration is essential for reversal. Diagnostic confirmation can be challenging, as available skin and serologic tests have

Figure 2: Personal Archive – Lateral view showing diffuse maculopapular skin eruptions with bluish discoloration.

limited sensitivity, and no validated preoperative prophylaxis protocols currently exist [2].

The incidence of severe adverse reactions to blue dyes (Patent Blue, Isosulfan Blue, Methylene Blue, and Indigo Carmine) used in sentinel lymph node biopsy for breast cancer and in melanoma surgery is low. Studies have shown that the risk of anaphylaxis is significantly lower in melanoma surgeries compared to breast surgeries. Furthermore, the use of smaller dye volumes (<2 mL) and intradermal administration are associated with reduced rates of anaphylactic reactions [6].

Although rare, adverse reactions to Patent Blue represent a potentially life-threatening complication for which no predictive tools or effective prophylactic measures currently exist. Therefore, surgical and anesthetic teams must maintain a high level of vigilance and readiness for immediate intervention.

This case underscores the importance of continuous perioperative assessment and post-extubation monitoring, particularly when using substances with known allergenic potential. The patient presented with acute cutaneous and respiratory symptoms following Patent Blue exposure, meeting the diagnostic criteria for anaphylaxis as defined by the NIAID/FAAN (National Institute of Allergy and Infectious Diseases/ Food Allergy and Anaphylaxis Network). The reaction was classified as Grade II anaphylaxis according to the Ring and Messmer scale—without hemodynamic instability but requiring pharmacologic intervention with epinephrine, antihistamines, and bronchodilators. The delayed onset of anaphylaxis highlights the importance of post-anesthesia care unit (PACU) monitoring protocols to ensure early detection and management of emerging symptoms, emphasizing the need for team preparedness even when prophylaxis is used [7,8].

Finally, the current trend toward surgical de-escalation in axillary management—with ongoing multicenter trials evaluating the possibility of omitting sentinel lymph node biopsy—may, in the future, reduce the use of Patent Blue and consequently decrease the incidence of associated complications.

PATIENT'S CONSENTE

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

HUMAN SUBJECTS

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. The paper has been sufficiently anonymized to keep patient's confidentiality.

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