

COST EFFICIENCY OF INDOCYANINE GREEN SURGERY IN BREAST CANCER SURGERY – LITERATURE REVIEW

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Breast cancer has an increasing incidence worldwide and therefore attention was focused on optimizing the therapeutic strategies in such cases; in both breast and axillary management a trend to de-escalation of the surgical treatment has been reported. This fact being possible especially due to the wide use of high technology systems such as angiography and near infrared imaging. Meanwhile, the wide usage of indocyanine green lead to better oncologic and cosmetic outcomes and lower rates of short term and long-term complications. The aim of this paper is to analyse the cost efficiency of indocyanine green and near infrared light in breast cancer patients.

Keywords: breast cancer, indocyanine green, near infrared, cost, efficiency

this surgical procedure is performed after a careful investigation of the medical record, a subcutaneous resection is the option of choice, followed by reconstruction. In all these cases indocyanine green proved to be a useful tool in order to increase the chances of a successful surgical procedure [8,9].

THE UTILITY OF INDOCYANINE GREEN AS PART OF THE THERAPEUTIC ARMAMENTARIUM IN BREAST CANCER PATIENTS

As mentioned before, the common introduction of indocyanine green in the armamentarium of breast surgeons proved to be an effective method in order to maximize both the cosmetic and the oncological outcomes [10,11]. Therefore, subcutaneous injection of this molecule followed by near infrared imaging offers real time information regarding the lymphatic and vascular structures offering the surgeon the possibility of performing a good quality surgical procedure. Therefore, the method has proven its utility in order to detect the sentinel node and to avoid unnecessary lymph node dissection, to detect the upper limb lymphatics and preserve them, fact which lowers the risk of developing upper limb lymphedema; in addition, it can detect the dilated lymphatic vessels after lymph node dissection and facilitate performing a lympho-venous anastomosis in order to treat this complication [1-4,12,13].

Meanwhile, due to the capacity of providing a real time angiography, indocyanine green proves to be an effective tool in order to minimise the risks of flap necrosis during breast reconstruction increasing in this way the safety and efficacy of the plastic reconstructive procedures [10-12].

A particular subgroup of patients in whom indocyanine green also proved to have a particular role is represented by those cases with non-palpable breast lesions; in such cases ultrasound guided indocyanine green injection at the level of the tumor followed by resection of all the fluorescent area when near infrared light is used, appears to be associated with good oncological results, negative resection margins being achieved. Last but not least, indocyanine green also is effective in drug delivery for certain particles of cytotoxic agents increasing in this way

INTRODUCTION

Wide introduction of screening programs for early detection of breast cancer conducted to a significant increase of the incidence of this malignancy worldwide and therefore, new conservative therapies have been performed [1-4]. Consequently, breast cancer surgery de-escalated from radical mastectomy to sectorial resections, while axillary management was de-escalated from standard axillar lymph node dissection to sentinel node dissection, so decreasing the rates of un-necessary lymph node dissections [1-3]. Meanwhile, breast cancer diagnosis at younger ages conducted to a higher rate of genetic testing and identification of a higher number of genetic mutation carriers, the most frequently incriminated ones being represented by BRCA 1/2 mutations; in such cases prophylactic mastectomy has been broadly demanded, the process being also known as "Angelina Jolie phenomenon" [5-7]. However, in young patients who desire prophylactic mastectomy and in which

the response to systemic chemotherapy [14]. As a result, this molecule has been widely implemented as part of different therapeutic strategies in breast cancer patients. In this respect, cost analysis studies developed in order to determine whether the method is affordable [15,16].

THE RATIONALE OF CONDUCTING A COST ANALYSIS IN INDOCYANINE GREEN USAGE FOR BREAST SURGERY

Initially, indocyanine green has been considered as a new weapon in the breast surgeon's equipment, which proofs its utility in both oncologic and reconstructive surgery and, therefore, associated certain supplementary costs when compared to standard surgery. So, attention was focused on determining whether the usage of these systems might decrease the rates of postoperative complications such as upper limb lymphedema or skin necrosis and also decrease the postoperative costs.

In the last years, due to the higher economic pressure on hospitals, cost reduction represents another important aspect; however, cost reduction should be carefully analysed and the cost-benefit relation should be considered when deciding if such an investment is a cost-effective one [15,16].

COST ANALYSIS STUDIES OF INDOCYANINE GREEN EFFECTIVENESS IN BREAST CANCER PATIENTS

An interesting study which analysed both the effectiveness and cost details when it comes to indocyanine green use for sentinel lymph node detection in breast cancer patients has been recently published by Somashekhar et al., which included 100 patients; in all cases technetium radiocolloid, methylene blue and indocyanine green were used [17]. Surprisingly, the identification rates in cases submitted to the dual method were 94% while in cases in which indocyanine green alone was injected was of 96%; the sensitivity rate was higher when using indocyanine green compared to the dual method (97.6% vs. 93.2%) while the false negative rate was lower (3.1% vs. 6.2%). No complications related to indocyanine green injection were observed while three cases presented local staining after methylene blue injection.

When it comes to the cost analysis, the authors demonstrated the fact that the dual method is also associated with higher costs, especially because it involves a nuclear medicine department and its staff, procurement, preparation and administration of a radioactive substance, using a gamma probe and a higher period of hospitalization with at least one day (technetium being usually injected a few hours to one day before surgery) [17]. Another cost-effectiveness analysis between indocyanine green and the dual method (including technetium and methylene blue) demonstrated that the costs can be lowered to 20% if indocyanine green is used when compared to the dual method [18].

Another important aspect which should be analysed when discussing about indocyanine green and its cost-effectiveness is related to its use in breast reconstructive surgery. Therefore, it seems that Spy system, near

infrared light and indocyanine green play a crucial role in diminishing the risks of flap necrosis especially when it comes to smokers, obese patients or patients with large breasts [19].

Last but not least, another important aspect which should not be omitted is related to the number of cases in which these devices are used; it seems to be perfectly justified to use such devices in high volume centres in order to decrease the rates of postoperative complications and the length of hospitalization. The number of cases is expected to be higher and, in the meantime, the costs of these devices to be faster amortised [19].

CONCLUSIONS

The wide usage of indocyanine green and Spy systems has significantly modified the concepts of breast surgery, increasing the number of cases submitted to conservative surgery, improving the oncological outcomes and the quality of life. Meanwhile, in high volume centres it proved to be a cost-effective tool, being associated with lower costs when used with both oncological purpose (detecting sentinel node) or cosmetic purpose (by lowering the risks of flap necrosis during reconstructive surgery).

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