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Comparative analysis between radioactive seed localization and wire-guided for non-palpable breast cancer surgery

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1. Introduction

Breast cancer is the most common women malignant neoplasm in Brazil[1]. Currently, as a result of the Health Ministry mammographic screening program, about a third of diagnosed breast cancers are in early stages[2], which makes it possible to carry out breast-conserving surgery, which is the removal of only the tumor. Lesions in early stages that yet are impalpable require an intraoperative marking method to help the surgeon to locate the lesion accurately, contributing to an adequate resection with negative surgical margins.

The most widely adopted approach for intraoperative marking of non-palpable breast tumors is wire-guided localization (WGL)[3,4]. The method consists of introducing the metallic wire into the area of the lesion, under mammography or ultrasound guidance. After positioning, the wire projects out of the breast, which requires care such as dressings and immobilization, to prevent wire breakage and displacement. Thus, the appointment and surgery must be performed on the same day.

One radio-guided option for labeling is localization with 125-iodine seed, first described in 1999 by Dauway et al[5]. In this technique, the radioactive seed is inserted into the breast, under mammography or ultrasound guidance, marking the site of the lesion, which is excised in the surgical procedure with continuous and audible assistance from a gamma detector. The greatest benefit of RSL highlighted in the literature[3,4] is the flexibility of surgical planning, because the seed can be introduced into the breast up to 2 months before surgery, due to the physical half-life of iodine-125, which is 59.4 days, improving the technical and organizational logistics for radiology and surgery teams[6]. The aim of this study is to investigate the efficiency of radioactive seed localization compared to metallic wire localization, evaluating the outcomes of positive surgical margins, intraoperative re-excision, reoperation and recurrence.

2. Methodology

The systematically research was performed in ClinialTrials.gov, Cochrane library, CRD database, EMBASE, HTA database, LILACS, PubMed, SciELO, Trip database and Web of Science from the earliest available data to August 2, 2021. The search strategy used, made in PubMed and adapted for the other databases, was: (((((breast cancer[MeSH Terms]) OR (breast surgery[MeSH Terms])) OR ((((breast cancer*) OR (breast neoplasm*)) OR (breast carcinoma*)) OR (breast lesion*))) OR (((((("nonpalpable") OR ("non palpable")) OR ("non-palpable")) OR ("impalpable")) OR ("occult"))) OR (((breast surgery) OR (radioguided surgery)) OR (lumpectomy*))) AND (((radioactive seed[MeSH Terms]) OR (((((((seed* localization*) OR (radioactive seed*)) OR (radioguided seed*)) OR (iodine seed*)) OR (iodine-125)) OR

(125I seed*)) OR (rollis)) OR (rsl))) OR ((((wire localization) OR (wgl)) OR (radioguided occult lesion localization)) OR (roll))).

We also searched for information in systematic reviews reference lists on the subject. The identified studies through the search strategy were selected after reading the title and abstract, when this was inconclusive, the article was analyzed in full text for inclusion. Data were extracted using a standardized form and, after analysis, were compiled according to the outcome measured.

3. Results and Discussion

Was identified 38 studies that met the inclusion criteria, 6 randomized controlled trials and 32 cohort studies. The population includes women with non-palpable invasive or ductal in situ breast cancer, aged 22-92 years, and includes patients who underwent neoadjuvant chemotherapy and bracketing localization. 32 studies reported the outcome of positive margin, 14 reported intraoperative re-excision, 27 reported reoperation and 3 reported recurrence.

The positive margin results, with a population of 6835 women in the RSL group and 8266 in the WGL group, was 15.8% and 17.3%, respectively. A total of 33.6% of 2437 women in the RSL group and 42.7% of 2671 in the WGL group required intraoperative re-excision. 12.6% of 6152 women in the RSL group and 15.7% of 7732 in the WGL group underwent reoperation. 527 patients in the RSL group and 998 in the WGL group were followed up for a period of 13-109 months, disease recurrence occurred - recurrence local, regional or distant metastasis - in 1.5% of the cases of RSL and 3, 6% WGL.

The evidence overall quality was good for randomized trials and moderate for cohort studies. The main bias risk among the randomized trials consisted of incomplete outcomes, data missing about selective outcome reporting, randomized allocation sequence and allocation sequence concealment. For cohort studies, the main risk of bias among consisted of baseline confusion, data missing and outcome measurement bias.

The conservative surgery success depends on the tumor complete removal, achieved with negative surgical margins. The positive margins occurrence is related to the disease recurrence risk, which, to be limited, needs reoperation. Overall, this study included a large group of patients receiving conservative surgery with either RSL or WGL, using real-world multicenter data about women with DCIS and IC, including neoadjuvant chemotherapy and bracketing localization cases. The RSL results for the analyzed outcomes was slightly better compared to WGL, implying that RSL is at least equivalent to WGL in terms of efficiency in intraoperative localization.

Once the seeds insertion can take place up to 2 months before the surgery, there is a logistical improvement for the radiology and surgery sector. The radiologist can see several cases a day to perform seed marking and patients do not need to go to the radiology department on the day of surgery. Thus, conservative surgeries with RSL can be the first surgical case of the day, improving the use of the operating room.

Patients underwent neoadjuvant chemotherapy can receive RSL implant prior to neoadjuvant treatment and thus will not need to undergo another localization procedure prior to surgery. This is especially important for patients who achieve a complete pathological response, as the seed will continue to mark the tumor local even with tumor regression[7].

The RSL technique implementation, due to its radioactive nature, requires the regulatory procedures establishment involving radiology, surgery and pathology departments. However, when the institution has a nuclear medicine department, the necessary personnel and equipment will be the same, what provide one sustainable implementation[8].

To support one localization technique over the other, more evidence about safety and services organization is needed, comprising aspects of patient assessment of pain, cosmesis and satisfaction related to the procedure; technique evaluation by the medical team; marker-related and postoperative complications; localization time; operative time; time interval between localization and surgery; and in addition, cost information.

4. Conclusions

The result of this study provides evidence that for patients with non-palpable breast cancer, RSL is a valid localization method, with efficiency equivalent to WGL. Can be applied in various indications for breast-conserving surgery with intraoperative localization, from patients who receive a single marker, to bracketing localization cases and associated neoadjuvant treatment. In addition to providing improvement the logistical organization of the radiology and surgery departments.

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