SUMMARY

Introduction/Objective About a third of the breast lesions on mammography are clinically occult. The goals of surgical treatment are to locate, remove, and verify their presence in the removed breast tissue. Standard specimen mammography (SSM) has been an official procedure for the latter, while intraoperative digital specimen radiography (IDSR) was introduced recently. The aim of this study was to evaluate the use of IDSR versus SSM and possible benefits regarding the duration of the procedures (operating room occupancy), availability of digital mammography for additional number of patients, surgeon productivity, and the quality of performed services.

Methods A retrospective chart review of 109 patients who underwent IDSR for nonpalpable breast lesions was performed between January 2014 and June 2016. We compared the difference in the duration of IDSR versus SSM procedure. We also observed the number of re-excisions and evaluated time-saving in the operating room workflow.

Results The average duration of surgery in the IDSR group of patients was 51 minutes, compared to 64 minutes in the SSM group. Every IDSR procedure saved 13 minutes over the standard SSM. That would allow another 28 procedures in the same time frame, with the same quality of service compared with SSM. In that way we increased productivity by 27.5%. Additional operation/surgery was needed for histologically involved surgical margins in three cases (2.73%).

Conclusion The use of new technology resulted in the rationalization of the operative room workflow and gave better productivity. More savings were obtained through the increase of digital mammography capacity for diagnostics, decrease of anesthesia duration, and better management of human resources. The number of “true” re-excisions, involving additional surgery, remained similar after introducing IDSR.

Keywords: nonpalpable breast tumors; specimen radiography; nonpalpable lesion localization

INTRODUCTION

The treatment of breast tumors has significantly advanced thanks to new technologies and new drugs, which have led to better understanding of the nature of the disease. Intraoperative digital specimen radiograph represents such a technology. It shortened the operative time, increased the productivity and decreased the work costs. A number of scientific papers report on the ways to rationalize the work of operating rooms [1, 2, 3].

Screening for breast cancer reveals an increased rate of nonpalpable changes which require the use of various techniques for their localization, followed by histological verification [4, 5]. The use of percutaneous core biopsy and vacuum-assisted biopsy solve diagnostics for a number of lesions without the need for surgery [6, 7, 8]. However, the malignancies confirmed by these biopsies, intermediary histological findings or suspicious malignancies, not suitable for core biopsies because of their localization, size, or other contraindications, should be managed by open biopsy. Localization of such lesions is often performed by a hook-wire, radiotracer (radioguided occult lesion localization), dye or metallic clips placed at the site of percutaneous biopsy, or it can be done by intraoperative ultrasound localization [9–13]. These markers help the surgeon localize and excise the lesion precisely. Because those lesions are often nonpalpable and/or invisible even in the excised tissue, it is necessary to confirm that they have been excised completely [11, 14, 15]. This can be achieved by standard specimen mammography (SSM) or intraoperative digital specimen radiography (IDSR) [16, 17].

The aim of this study was to evaluate the use of IDSR, which replaced previous SSM in December 2013. We assessed possible benefits regarding the duration of surgery and operating room occupancy, availability of digital mammography for additional number of patients, surgeon productivity, and the quality of performed services. This method allows surgeon and/or radiologist to immediately interpret the specimen in the operating room.
A retrospective study of patient charts and operative protocols gave us the data for 109 patients from 2014 to June 2016. Around one half of the patients underwent preoperative percutaneous biopsy, while the rest was proven by frozen section during their surgery. In case of histologically confirmed or suspicious lesions for infiltrative carcinoma visible on ultrasonography, lesion localization was performed primarily by a radiotracer, which allows sentinel node identification, or we used wire localization with para-areolar injection of the radiotracer. Otherwise, the sentinel node (SN) would have to be examined in a separate procedure. The third method is the use of ultrasound pre- and intraoperatively for lesion localization. The preoperative part is often done by a radiologist by marking the lesion over the skin; intraoperatively, ultrasound is available to surgeons. After lesion localization, all patients underwent breast conserving surgery with or without SN identification, and axillary dissection for metastases. The durations of the procedure for the IDSR group were obtained from the operative protocols. Since the SSM procedure duration differs from IDSR only in the time needed for transportation, the radiological technicians needed to obtain a specimen mammogram, and the radiologists to interpret it, we simply calculated and added that time to the results we obtained for the IDSR group (Table 1). These measurements were taken three times by a stopwatch and the average time was six, five, and three minutes. We never considered the possibility of mammogram examination of a patient being in progress, which would prolong every procedure for up to 20 minutes.

We divided all the IDSR patients into subgroups in order to precisely evaluate the time needed for tumor excision in the following way: those who had re-excision, SN identification, or both (re-excision + SN), and those who underwent axillary dissection.

In addition, we estimated the total number of additional surgeries for the group. The productivity was assessed in relation to the predicted time-saving with the use of IDSR.

**RESULTS**

The localization procedures were pre- and intraoperative ultrasound in 66 (60.5%) cases, “hook-wire” in 29 (26.6%), and radioguided occult lesion localization in 14 (12.8%) cases. Out of 109 lesion localizations, 52 (47.7%) patients underwent preoperative percutaneous biopsy; the remaining 57 (52.3%) lesions were proven by frozen section analysis of the resected margins. The average 51 minutes would be prolonged...
another 11 minutes if re-excision was needed. In case of SN identification, the average time is 66 minutes, a combination of the two would give 83 minutes, and up to 97 minutes for axillary dissection.

The number of re-excisions during the procedure was 33 (30.3%). Additional surgery was needed for histologically involved surgical margins in three cases (2.75%). In one case after the second surgery and lobular carcinoma in situ on the margin, mastectomy was performed (Table 3).

**DISCUSSION**

It must be said that in SSM procedure potential errors regarding the identification, orientation, and transportation of the excised specimen are possible; this can lead to misinterpretation of resected margins by the histopathologist. Compression of the specimen during mammography imaging can cause overlapping of the margins, which can result in false positive or negative excised margins. The use of IDSR allows for an immediate evaluation of the specimen, confirmation of the complete removal of targeted tissue, and the assessment of excised margins. Our study confirmed that the procedure was shorter by 13 minutes with IDSR compared to SSM. Similar findings were reported in a study by Kaufman et al. [18]. Other studies do not state similar results [19]. Our results showed that preoperative percutaneous biopsy and histological verification of an occult lesion did not shorten the duration of the procedure significantly. It can be explained by the practice of frozen section analysis of surgical margins in all patients in addition to IDSR.

Every IDSR procedure saved 13 minutes over the standard SSM. That would allow another 28 procedures in the same time frame, with the same quality of service compared with SSM. In that way we increased productivity by 27.5%.

We expect more benefits in the future knowing the impact to the learning curve and engagement of all surgeons in the IDSR procedure.

Different studies report positive resection margins in up to 40% of the patients treated with breast conserving surgery [20, 21]. This leads to additional surgery, adverse effects on cosmetics, psychological distress, and higher costs.

According to other authors, the percentage of re-excisions performed in the course of operation is comparable to ours (30%) [17, 22], or lower [18, 23]. IDSR optimizes the surgical procedure because the surgeon, radiologist, and histopathologist have a real-time information about the positive resection margins [22]. It is now possible to exchange opinions directly with no additional time consumption. We had tree re-operations (2.75%) in our study; McCormick et al. [23] found this percentage to be 12%, and after two-view specimen mammography they reduced this rate to 5% [23]. The future goal is to avoid additional operations and increase productivity as much as possible.

**CONCLUSION**

The use of new technology resulted in the rationalization of the operative room workflow and gave better productivity. More savings were obtained through the increase of digital mammography capacity for diagnostics, decrease of anesthesia duration, and better management of human resources. The use of this method slightly increased the number of re-excisions during the primary operation. The number of “true” re-excisions, involving additional surgery, remained similar after introducing IDSR.

The use of IDSR in everyday practical work has made possible rapid creation and interpretation of specimen radiograms and making immediate surgical decisions based on these images.

**REFERENCES**


13. DOI: https://doi.org/10.2298/SARH161215071V

Table 3. Number of additional surgeries indicated by involved surgical margins

<table>
<thead>
<tr>
<th>No.</th>
<th>Primary “frozen section” procedure</th>
<th>Additional (second) surgery</th>
<th>Three or more procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Free margin (2 mm) on the frozen section</td>
<td>CDI, G2 on the margin</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>No tumor on the margin</td>
<td>CLI, LCIS on the margin</td>
<td>LCIS on the margin solved by mastectomy</td>
</tr>
<tr>
<td>3.</td>
<td>No tumor on the margin</td>
<td>DCIS, G2 on the margin</td>
<td>-</td>
</tr>
</tbody>
</table>

CDI – carcinoma ductale invasivum; CLI – carcinoma lobulare invasivum; LCIS – carcinoma lobulare in situ; DCIS – carcinoma ductale in situ
Интраоперативна дигитална радиографија узорка у третману непалпабилних промена дојки

Ференц Вицко1,3, Зоран Радовановић1,3, Татјана Ивковић Капицл1,3, Драгана Ђилас1,3, Дејан Лукић1,3, Миланка Татић1,3, Татјана Петровић2

1 Универзитет у Новом Саду, Медицински факултет, Нови Сад, Србија; 2 Институт за плућне болести Војводине, Сремска Каменица, Србија; 3 Институт за онкологију Војводине, Сремска Каменица, Србија

САЖЕТАК
Увод/Циљ Трећина мамографским прегледом нађених промена у дојки је непалпабилна. Циљ хируршког лечења је да локализује, уклони и потврди промене у одстранењу тумора. Мамографија узорка је била стандардна метода за потврду, а интраоперативна дигитална мамографија је уведене недавно. Циљ рада је био да се одреди евентуална предност интраоперативне дигиталне радиографије узорка за потврду, а интраоперативна дигитална мамографија је уведене недавно.

Методе Ретроспективно је анализирано 109 картона болесника са ИДРУ од јануара 2014. до јуну 2016. Време трајања операције са ИДРУ је упоређивано са временом трајања операције код СМУ. Посматран је број резекција и процењена је штета у времену рада операциона сале.

Резултати Просечно време трајања операције је 51 минут у групи ИДРУ у односу на 64 минут код СМУ. Свака процедура ИДРУ је донела уштеду у времену од 13 минута у односу на СМУ код СМУ. Услед та уштеда је рационализација урада операције и повећана је продуктивност за 27,5%. Друга хируршка интервенција је због позитивних ресекционих ивица потребна у броју 28 додатних процедура у односу на 32 код СМУ.

Закључак Увећање времена трајања бољих узорака у збилима врло је рационализацији у раду операциона сале и рационализацији у управљању. Број реекспрензији у другом акту је практично непромењен након увођења ИДРУ.