Mini review

Section 5. Breast
Overview: video-assisted breast surgery

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Abstract

Since 1992, video-assisted surgery for the breast has been developed mainly in the field of plastic surgery, notably in breast augmentation surgery. Today, video-assisted surgery, indicating partial or total endoscopic surgery, can be performed for the treatment of both benign and malignant breast tumors to improve the cosmetic outcome. Although, in some respects, this kind of surgery for malignant tumors is still experimental, it is feasible enough for clinical use, and is expected to become one of the standard operations for breast cancer. © 2002 Éditions scientifiques et médicales Elsevier SAS. All rights reserved.

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1. Introduction

One of the advantages of video-assisted surgery, which is also known as endoscopic surgery, is that it can be performed via small and remote incisions. From this point of view, it is quite understandable that video-assisted breast surgery was first developed in the field of the esthetic and plastic surgery for the breasts. Since Kompatscher [1] described the technique of endoscopic capsulotomy of capsular contracture after breast augmentation in 1992, numerous reports regarding video-assisted breast augmentation have been produced [2-9]. Today, it has become a standard technique for breast augmentation.

On the other hand, video-assisted surgery for breast tumors has been examined only very recently. As a surgical technique, it may still be challenging, but it has the potential of becoming an important alternative approach for both benign and malignant tumors of the breast. In this article, we review reports of video-assisted surgery for breast tumors and axillary lymph nodes, and discuss the present problems of and future possibilities for such surgery.

2. Video-assisted surgery for breast tumors

The first report regarding video-assisted surgery for breast cancer was written by Friedlander et al. [10] in 1995. They performed experimental surgery using an endoscope and an original tripod elevator initially on porcine models and thereafter on cadavers. Their surgery consisted of total glandectomy, axillary dissection and reconstruction of the breast with the rectus abdominus muscle. They thought of applying this surgery to patients with large ductal carcinoma in situ and lobular carcinoma in situ who required complete removal of the mammary gland. They also suggested the application of such surgery for benign breast disease. However, no clinical application has been reported since their first experimental report.

Clinical reports of video-assisted surgery for breast tumors are summarized in Table 1. In 1997, Yamagata and Iwai [11] reported on endoscopic partial mastectomy and axillary dissection for breast cancer. They performed partial mastectomy using a lifting system, and axillary lymph node dissection under gas insufflation after blunt dissection using a balloon system. The average operation time was 158 min, and blood loss was 25–250 g.

In 1998, we reported on the preliminary results of video-assisted partial mastectomy performed on a patient...
with a small breast cancer [12]. A working space was created by subcutaneous dissection using a special endoscope-retractor system and bipolar scissors. A wide excision of the tumor was performed endoscopically through a single small wound in the axilla, and total clearance of the axillary nodes from the same wound with the naked eye. Ishiguro et al. [13] reported a similar surgery in 1999. Although this technique proved to have greater cosmetic advantages over those obtained by routine open surgery, the lengthy operation time could not be disregarded. To overcome this problem, we moved the primary incision from the axilla to the periareolar region [14]. The mean total operation time was reduced from 387 to 241 min, and the partial glandectomy itself was performed in 87 min on average. In the latter cases, a sentinel lymph node biopsy was performed through another small incision made in the axilla. If a frozen section of the lymph nodes was pathologically positive with cancer cells, total clearance of the axillary nodes was performed with the naked eye from the same wound enlarged to a length of 5 cm. The cosmetic result was satisfactory (Fig. 1).

For a patient with multiple tumors or extensive intraduc-tal components (EIC) of breast cancer, total glandectomy or subcutaneous mastectomy with immediate reconstruction may be considered [15,16]. Sawai et al. [17] reported on video-assisted total glandectomy and immediate reconstruction with the latissimus dorsi muscle in 2001. They removed both the mammary gland and the axillary lymph nodes endoscopically via a 5-cm long skin incision in the midaxillary line. Their surgery will bring immense cosmetic benefit to patients with primary breast cancer who cannot receive breast conserving surgery.

With regard to video-assisted surgery for benign breast tumors, Kitamura et al. [18] reported on the first case of tumorectomy for a large fibroadenoma. They used three trocars on the midaxillary line and the subcutaneous working space was maintained by gas insufflation. Following this, they performed the same surgery on 35 patients, and concluded that this surgical approach was the best option for benign breast tumors [19]. On the other hand, Osanai et al. [20] performed tumorectomy for benign tumors approaching from the retromammary space. Though the procedure would be rather difficult to perform for a large tumor or for a tumor located on the surface of the gland, it had the advantage of causing less injury to the skin such as burns and numbness.

3. Video-assisted axillary dissection

Another application of video-assisted surgery for breast cancer is endoscopic sentinel lymph node biopsy and axillary dissection. A list of published reports on this surgery is shown in Tables 2 and 3. The most important and difficult problem was how to create a working space in the axilla. One of the solutions used to overcome this problem is fat suction aspiration. Since Suzanne et al. [21] reported on the simplicity and safety of axillary lymphadenectomy

![Fig. 1](image_url)
with fat aspiration in 1993, this technique has become the standard technique for endoscopic axillary dissection. In 1996, Salvat et al. [22] reported the results of a randomized study comparing endoscopic sampling and open surgery for axillary lymph nodes of breast cancer patients. One hundred and fifty milliliters of lipolysis solution were injected into the axillary space, and the fatty tissue surrounding the axillary lymph nodes was removed by suction aspiration, following which CO2 gas was insufflated into the space. The average operative time was 60.9 min in the endoscopic group and 33.3 min in the surgical group. Other than operation time, there were no statistical differences between the two groups in the duration of hospital stay, immediate post-operative complications, the number of lymph nodes removed, and the size of the lymph nodes. Following this report, several clinical applications of axilloscopy for lymph node clearance following liposuction were performed [23-26]. However, the liposuction technique has a problem in that it might destroy the integrity of the lymph nodes. To avoid the risk of the tumor spreading by liposuction, Kamprath et al. [27] performed endoscopic axillary lymphadenectomy without prior liposuction in 1999. They used a blunt dissection technique instead of liposuction, and revealed that it could be performed safely. In 2001, Malur et al. [28] performed the same surgery, and reported a similar result in 100 patients with invasive breast cancer. Most of these reports concluded that endoscopic axillary lymphadenectomy produced better cosmetic outcome with fewer sensory disturbances [29].

On the other hand, some recent reports disclaimed the advantages of endoscopic axillary lymphadenectomy over conventional surgery. Kuehn et al. [30] compared the post-operative courses and complications of the two approaches and indicated that there were no differences except for a longer operation time in the endoscopic group. They concluded that endoscopic axillary lymphadenectomy offers no advantages over conventional surgery, though the former can achieve better cosmetic results. Other than the cosmetic benefits, however, the advantages of endoscopic axillary lymphadenectomy remain unclear, and therefore further follow-up is needed.

### 4. Discussion

Breast conserving surgery has become one of the standard operations for breast cancer since Veronesi et al. [31] and Fisher et al. [32] reported the results of large studies in the 1980s. The surgery was originally investigated to improve cosmetic outcomes in breast cancer treatment, and has brought great benefits to patients. In this sense, video-assisted breast surgery can be regarded as the ultimate surgery in pursuing better cosmetic results as it can be performed via a small and remote wound which becomes inconspicuous after surgery.

One of the prime objectives of breast cancer surgery is to avoid local recurrence. To achieve this, complete removal of the tumor is needed even in video-assisted breast surgery.

### Table 2

**Video-assisted axillary clearance for breast cancer**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Creation of working space</th>
<th>N° of patients</th>
<th>Mean operation time (min)</th>
<th>Mean n° of nodes</th>
<th>N° of seroma (%)</th>
<th>Ref. n°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salvat et al.</td>
<td>1996</td>
<td>LS + GI</td>
<td>20</td>
<td>60.9</td>
<td>12.9</td>
<td>5 (25)</td>
<td>22</td>
</tr>
<tr>
<td>Suzanne et al.</td>
<td>1997</td>
<td>LS + GI</td>
<td>72</td>
<td>–</td>
<td>14</td>
<td>2 (2.8)</td>
<td>23</td>
</tr>
<tr>
<td>Brun et al.</td>
<td>1997</td>
<td>LS + GI</td>
<td>34</td>
<td>–</td>
<td>15</td>
<td>–</td>
<td>24</td>
</tr>
<tr>
<td>Harder et al.</td>
<td>1998</td>
<td>LS + GI</td>
<td>50</td>
<td>–</td>
<td>13.4</td>
<td>–</td>
<td>25</td>
</tr>
<tr>
<td>Kamprath et al.</td>
<td>1999</td>
<td>BG + GI</td>
<td>33</td>
<td>74.9</td>
<td>14.5</td>
<td>2 (9.1)</td>
<td>27</td>
</tr>
<tr>
<td>Cangiotti et al.</td>
<td>1999</td>
<td>LS + GI</td>
<td>15</td>
<td>–</td>
<td>15.5</td>
<td>1 (6.7)</td>
<td>26</td>
</tr>
<tr>
<td>Kühn et al.</td>
<td>2000</td>
<td>LS + GI</td>
<td>35</td>
<td>–</td>
<td>17</td>
<td>–</td>
<td>37</td>
</tr>
<tr>
<td>Kuehn et al.</td>
<td>2001</td>
<td>LS + GI</td>
<td>34</td>
<td>110</td>
<td>17</td>
<td>8 (23.5)</td>
<td>30</td>
</tr>
<tr>
<td>Malur et al.</td>
<td>2001</td>
<td>BD + GI</td>
<td>100</td>
<td>75</td>
<td>16</td>
<td>4 (4.0)</td>
<td>28</td>
</tr>
</tbody>
</table>

<sup>a</sup> LS, liposuction; BD, blunt dissection; GI, gas insufflation method; ER, external retraction method.

### Table 3

**Video-assisted sentinel lymph node biopsy for breast cancer**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Creation of working space</th>
<th>Tracer&lt;sup&gt;b&lt;/sup&gt;</th>
<th>N° of patients</th>
<th>Detection rate (%)</th>
<th>Ref. n°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsangaris et al.</td>
<td>1999</td>
<td>BD + GI</td>
<td>Dye</td>
<td>19</td>
<td>57.9</td>
<td>26</td>
</tr>
<tr>
<td>Kühn et al.</td>
<td>2000</td>
<td>LP + GI</td>
<td>Dye</td>
<td>35</td>
<td>83.3</td>
<td>37</td>
</tr>
<tr>
<td>Winzer et al.</td>
<td>2001</td>
<td>LP + GI</td>
<td>RI</td>
<td>4</td>
<td>75.0</td>
<td>38</td>
</tr>
<tr>
<td>Fukuma et al.</td>
<td>2001</td>
<td>BD + ER</td>
<td>RI + Dye</td>
<td>40</td>
<td>92.5</td>
<td>39</td>
</tr>
</tbody>
</table>

<sup>a</sup> LS, liposuction; BD, blunt dissection; ER, external retraction method; GI, gas insufflation method.

<sup>b</sup> RI, radio tracer.
The size of the removed tissue should be the same as that removed by conventional surgery, and from this point of view, it may not be considered a minimally invasive surgery. As video-assisted breast surgery is performed in a narrow working space and with limited handling of the instruments, there may be some risk of incomplete resection. Adequate preoperative examination by the diagnostic imaging devices and strict selection of patients is needed, and can avoid the risk of local recurrence. For this reason, video-assisted resection of breast cancer has been developed mainly in Japan, as Japanese women generally have smaller breasts than women in the West. Conventional breast conserving surgery in Japan is performed by wide resection of the tumor with a sufficient free margin using subcutaneous dye markings [33]. It is easy to apply video-assisted surgery to this type of operation. However, it appears difficult to perform all the procedures in this surgery endoscopically for patients with large breasts. It is necessary to develop some special tools to indicate the resection line and cut the gland efficiently.

On the other hand, video-assisted total glandectomy can be performed without regard to the size of the breasts. However, it requires reconstruction of the breast, and this procedure may require additional incisions to obtain tissue for filling the space. The benefit of using an endoscope may be reduced, especially in the case of reconstruction with the musculo-cutaneous flap. Therefore, use of saline bags might prove to be a better choice for immediate reconstruction in such cases.

Video-assisted axillary dissection is another application of endoscopic surgery for breast cancer. This technique has been developed mainly in Europe, and seems to have significant advantages from a cosmetic point of view, especially when performed in combination with sentinel lymph node biopsy. Sentinel lymph node biopsy has been investigated widely, and is expected to become a standard in breast cancer surgery [34,35]. Recently, some investigators have reported on endoscopic sentinel node biopsy and its superior, high rate of identification [36-39]. Furthermore, in those cases where total axillary cleaning following sentinel node biopsy is required, video-assisted axillary lymphadenectomy would be useful because it can be performed through the same incision without enlargement of the wound. However, some investigators have doubts about its clinical benefits [28], and have pointed out the risk of dissemination of cancer cells by liposuction [26,27]. Other techniques, for example, blunt dissection and balloononing dissection, should be examined in a large number of patients, and the safety should be confirmed.

Video-assisted surgery for breast neoplasms has been developed in less than 10 years and is still experimental in some respects. Its potential, however, is promising and is expected to become one of the standard operations for breast disease. To reach this goal, new and special tools must be developed, and a large clinical trial should be performed to prove its safety. Furthermore, a long follow-up of the patients will be required.

References
