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Minimally invasive surgery for axillary dissection

Cadaveric feasibility study

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Abstract. Axillary dissection is the major cause of morbidity in breast cancer and primary cutaneous melanoma of the extremity. In the present study, we examine the potential benefits and advantages of endoscopic axillary lymph node dissection over conventional surgery. Twenty endoscopic axillary dissections and 10 lymph node samplings were performed in 10 cadavers (four male, six female). A preperitoneal distention balloon (PDB) system was used to dissect the axilla. In four of the cadavers, the procedure was followed by open surgery. The axillary contents were examined for lymphatic tissue by a pathologist. The endoscopic technique offered easy access to the axilla and clear visualization of the axillary vein, as well as the long thoracic and thoracodorsal nerves. Results were comparable to those achieved with the classic surgical dissection. Endoscopy is feasible for axillary lymph node dissection and sampling in cases of breast cancer and primary cutaneous melanoma of the extremity. Further studies in patients are needed to reach definitive conclusions.

Key words: Endoscopy — Balloon dissection

Axillary lymph node involvement is the most important prognostic factor in patients with breast cancer [1, 3, 13]. Traditional axillary lymph node dissection is preferred over axillary lymph node sampling for pathological evaluation. In many medical centers, however, traditional lymph node dissection has recently been reduced to level one and two dissection. In 1991, Morton et al. [12] described a new method of axillary lymph node mapping in patients with malignant melanoma for predicting the staging of the disease; in 1995 Armando recommended sentinel lymphadenectomy as a staging procedure for breast carcinoma [8].

Axillary lymph node dissection remains the major cause of morbidity after breast cancer surgery [2]. In view of the increasing popularity of endoscopy in many surgical fields [4, 6, 7, 10], we evaluated the potential role of this method in axillary dissection or mapping in a cadaveric feasibility trial.

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Materials and methods

An axillary endoscopic procedure was performed on 10 fresh human cadavers (four male, six female) at the Pathological Institute for Forensic Medicine, Tel Aviv University.

The cadaver was positioned supine on the operating table with the arm maximally abducted. A 10-mm skin incision was made in the mid-axillary line at the mamillary level. A round preperitoneal distention balloon (PDB) was tunneled in the direction of the apex of the axilla, between the axillary fascia and serratus and latissimus dorsi muscles. The balloon was advanced to the humerus head at the apex of the axillar and inflated by pumping the bulb no more than 40 times, until an adequate working space was created. The balloon was inserted blindly up to the apex, and the positioning of the balloon and of the camera after inflation was confirmed manually from above.

After insufflation, the PDB balloon was removed and replaced with a blunt-tipped trocar. The latter was connected to the insufflator to keep the pressure at 10–12 mm Hg. The trocar was fixed under the skin incision by inflating the balloon tip with 30 cc of air (Fig. 1).

A 0° angle endoscope was then inserted through the trocar and the anatomical space of the axilla inspected. Two more 5-mm trocars were placed in the transverse mamillary line, 10 cm from each side of the endoscope; one was for the forceps and the other was for the dissecting scissors, which were connected to a diathermy device (Fig. 2).

The first step in the dissection was to identify the axillary vein at the apex of the axilla and to dissect the axillary content from the axillary vein caudally in order to identify the long thoracic and thoracodorsal nerves. Following removal of the balloon and insertion of the camera, the open,

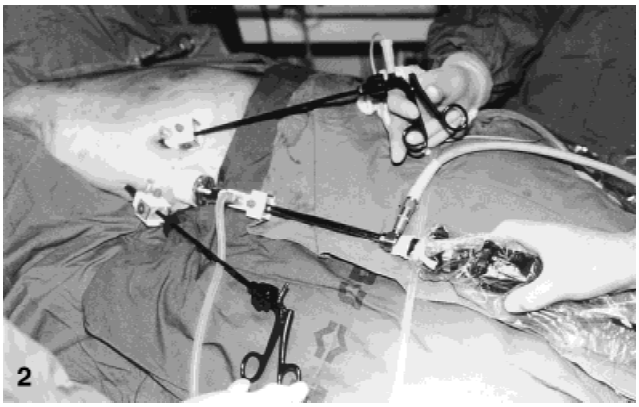

Fig. 1. Insertion of the structural balloon trocar. The balloon trocar is inflated outside the axillar to demonstrate its function.

Fig. 2. All three trocars in place with the camera in the middle.

separated axillary space could be clearly observed and the axillary vein identified in the superior part; in some cases, slight blunt dissection was necessary. Points of reference were the axillary vein in the apex, latissimus dorsi muscles laterally, and the serratus muscles anteriorly and medially. The long thoracic nerve was generally easy to identify immediately after insufflation, or after an additional blunt dissection on the chest wall, in order to view it lying on the muscle. The small vessels were managed with diathermy and the larger ones with pins. The thoracodorsal nerve was more difficult to identify; to do so, we dissected the axillary vein caudally along the posterior thoracic wall. (In live patients, the surgeon can see the contraction of the muscle during diathermy, which assists in its identification and prevents nerve damage). The dissected axillary content was placed in an endobag and removed through the 10-mm trocar.

In four cases, semi-Morton mapping procedure was performed by injecting 1 ml of patent blue dye into the axilla and then sampling the lymph nodes that were stained. The nodes were dissected at levels 1, 2, and 3. After completing the endoscopic dissection, the results were evaluated by open axillary dissection.

Results

Endoscopic axillary lymph node dissection or sampling was successful in all 10 cases. There were no major technical problems. Axillary dissection posed no difficulties, and visualization of the long thoracic nerve was good thanks to the use of the PDB. Average operating time was 40 min for dissection and 20 min for lymph node sampling. There was no injury to the major structures. In three cases, subcutaneous emphysema was noted when the clavico-pectoralis fascia was opened by trocar for dissection. On pathological study, all tissues stained positive with patent blue, and axillary content showed sufficient lymphatic tissue—1–3 lymph nodes in each for sampling and 6–23 for axillary dissection.

Open surgery performed after endoscopic surgery in four cases confirmed that the endoscopic technique had spared the nerve and vein and enabled good dissection of the lymphatic tissue.

Discussion

Our use of balloon-assisted endoscopy for postmortem dissection and sampling of axillary lymph nodes shows that this procedure has several potential advantages over open surgery.

Axillary dissection in carcinoma of the breast is important for establishing local control, determining treatment, and estimating prognosis [11]. Some authors believe it should not be performed in selected groups, such as postmenopausal women with tumors of <2 mm [9, 14, 15].

The success of laparoscopic cholecystectomy has prompted intense efforts to apply this technology to other operative procedures [5, 18]. Endoscopy has been shown to shorten hospital stay and to yield better cosmetic results than conventional surgery [16]. Although the axillary region is easily accessible by conventional surgery, we would recommend the endoscopic approach for axillary lymph node dissection and sampling. We used this approach in 10 fresh cadavers for 20 axillary dissections and lymph node sampling. The application of a PDB system, as described for total preperitoneal laparoscopic inguinal herniorrhaphy [17], enabled us to perform a blunt dissection and create a delimited anatomic space within the axilla, which is more difficult to achieve with insufflation alone. Replacement of the balloon with a trocar allowed for quick and easy access to the axillary anatomy for good visualization of the axillary vein, the serratus and latissimus dorsi muscles, and the long thoracic and thoracodorsal nerves. Unlike open surgery, endoscopic dissection does not require traction, so there is less tissue destruction, and, we may assume, fewer seromas. Since there is no damage to the nerves or large blood vessels, chances of complications and postoperative infections are slight. The results were comparable with those obtained with open surgery. Furthermore, the aesthetic outcome is good—three small incisions compared to a single, very large one with the traditional method, and therefore, no contraction in the scar area in the axilla. In the presence of indications for biopsy only, the cosmetic results are even better, and there is no tissue damage at all.

It should of course be emphasized that this is a cadaveric trial study to test a new surgical technique, and much more clinical experience is needed before definitive conclusions are reached.

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