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Technical note

Robot-assisted transaxillary thyroidectomy: Surgical technique

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ABSTRACT

Robot-assisted transaxillary thyroid surgery avoids the need for a neck incision. It consists of thyroid lobectomy and isthmectomy for moderately large unilateral benign nodules. The surgical imperatives are the same as for conventional surgery, but with differences in terms of patient positioning, surgical incision, equipment, surgical technique and indications. The purpose of this article is to describe the equipment, patient positioning and surgical technique of exclusive robot-assisted transaxillary total thyroid lobectomy and isthmectomy.

1. Introduction

Thyroidectomy, without a visible scar, represents a surgical challenge corresponding to a legitimate request expressed by the patient. One of the proposed approaches is to perform an axillary incision. This procedure has become very popular with the development of the Da Vinci robot (Intuitive Surgical Inc., CA), which improves the precision and surgical comfort compared to the non-robotic transaxillary endoscopic technique. More than 6000 robot-assisted thyroidectomies were performed in Korea between 2007 and 2011 [1], mainly total thyroidectomies with central compartment lymph node dissection for cT1N0 papillary carcinomas. Korean series report similar complications and oncological results to those of conventional surgery [2].

Surgical imperatives (functional preservation of the recurrent laryngeal nerve [RLN] and parathyroid glands) are the same as in conventional surgery, but with differences in terms of patient positioning, equipment and surgical technique. A protocol clearly defining the procedure and patient selection criteria is therefore essential. The authors describe the surgical technique based on a series of 26 cases of exclusive robot-assisted transaxillary thyroid surgery (RATS) (lobectomies and isthmectomies) performed for benign nodules.

2. Surgical technique

2.1. Patient positioning

The patient is intubated with an endotracheal tube comprising recurrent laryngeal nerve (RLN) monitoring (NIM 3.0 Medtronic, MN), and placed in the supine position with moderate Rose position (Fig. 1a). The arm on the side of the lobe to be operated is placed above the head, without exceeding 125° of antepulsion, with the elbow flexed to 90° and with the forearm over the forehead supported in a hammock with protective gel by an inverted bracket attached to the table on the opposite side to the incision; a bolster placed underneath the ipsilateral shoulder, and the contralateral arm left alongside the body.

2.2. Axillary incision and creation of the working space

The incision is performed by "direct" surgery. Landmarks are marked with a skin marker pen (Fig. 1b). Sterile drapes include the axillary, anterior cervical and prepectoral regions, allowing surveillance of skin integrity during the incision and possible conversion to anterior neck surgery.

The skin incision, 6 to 9 cm long according to the patient's morphotype and the size of the thyroid nodule, is extended as far as the pectoralis fascia. The surgical assistant, opposite the operator, retracts the tissues with Farabeuf retractors. Dissection is performed with an electrical scalpel in the prepectoral fascia as far as the sternocleidomastoid (SCM) muscle and thyroid gland. The increasing depth of the dissection tunnel requires long instruments (20 to 30 cm) and a vaginal retraction valve. The lesser

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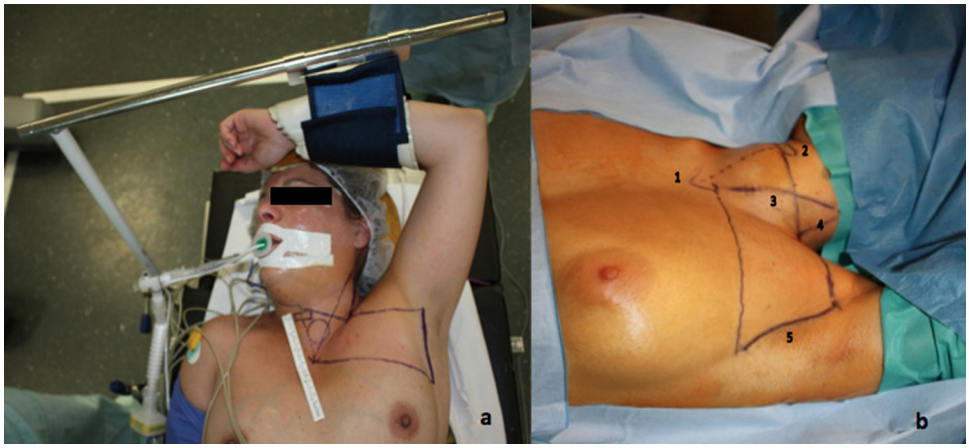

Fig. 1. Patient positioning (a) and anatomical landmarks (b): a: exposure of the axilla by extension of the shoulder and flexion of the elbow to 90° to achieve the shortest distance between the axilla and the thyroid gland; b: sternal notch (1), inferior margin of the cricoid cartilage (2) and superior pole of the thyroid lobe when palpable, anterior (3) and posterior (4) margins of the sternocleidomastoid muscle and midline. Two transverse lines are drawn from the sternal notch and inferior margin of the cricoid cartilage to the midaxillary line. Their intersections with the midaxillary line define the limits of the axillary incision (5). These lines delineate the dissection corridor of the incision. The italic S-shaped incision in the midaxillary line must be hidden in the axilla when the arm is in the neutral position, and measures 6 to 8 cm.

supraclavicular fossa between the sternal and clavicular heads of the SCM muscle is used. The internal jugular vein is preserved posteriorly. A small or large endoscopic clip applier (Ligaclip, Ethicon Endosurgery) can be used to control afferent veins. The strap muscles are released from the anterior surface of the thyroid lobe over a distance ranging from the sternal notch to the superior pole of the thyroid lobe, thereby creating the working space. A Chung retractor (Biorobotics, Korea), attached to the table on the opposite side to the incision, retracts the sternal head of the SCM muscle and the strap muscles. The Chung retractor passes over the patient's contralateral shoulder from the incision to the working space (Fig. 2).

2.3. Positioning of the robot

The Da Vinci® Si-HD surgical robot (Intuitive Surgical Inc.) consists of a surgeon console that controls the instrument holder on the patient side and a high definition telemonitoring screen. The four arms of the robot carry: a 12 mm 30° endoscope directed downwards, Maryland dissecting forceps, Prograsp fenestrated forceps, Ultracision harmonic scalpel (Ethicon Endosurgery, GA).

The sterile draped robot is advanced to the patient's head, on the side opposite to the incision in the axis of the Chung retractor. The position of the camera and instruments in the axillary single incision is defined in order to allow maximum mobility and to prevent instrument conflicts: camera directed upwards with respect to the floor (20° to 30°) and the patient's feet (10° to 20°), Maryland and Ultracision harmonic scalpel placed on either side of the camera and directed towards the floor with a craniad direction for the instrument on the caudad side of the incision (Ultracision harmonic scalpel for a right-sided procedure) and a caudad direction for the instrument on the cranial side. These two instruments and the camera form an equilateral pyramid with a summit situated

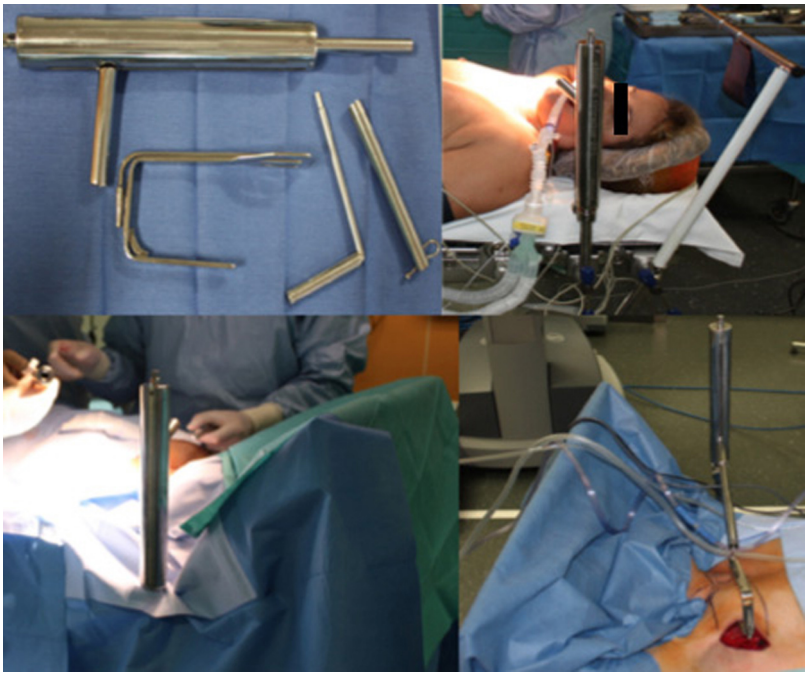

Fig. 2. Exposure of the working space using the Chung retractor. Exposure of the working space using the Chung retractor (Biorobotics, Korea) attached to the table on the opposite side to the incision, passing over the patient's shoulder and angled towards the thyroid to retract the sternal head of the SCM muscle and the strap muscles.