



## ORIGINAL ARTICLE

# Hemostatic Systems in Thyroid Surgery and Complications<sup>☆</sup>

José Luis Pardal-Refoyo

Servicio de Otorrinolaringología, Sección de Cirugía Tiroidea y Paratiroidea, Hospital Virgen de La Concha, Zamora, Spain

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### KEYWORDS

Thyroid;  
Thyroidectomy;  
Complications;  
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Harmonic;  
Scalpel

### Abstract

**Introduction:** There have been significant technological advances for hemostasis in thyroid surgery, that allow more precise and safer vascular sealing than the traditional bond associated with mono- or bipolar electrocoagulation.

**Objective:** To compare the complications in total thyroidectomy using traditional techniques (ligation and electrocoagulation, including LigaSure) compared to the exclusive use of the Ultracision Harmonic scalpel, performing dissection, cutting and hemostasis simultaneously.

**Methods:** Retrospective descriptive non-randomised comparative study with 887 patients who underwent total thyroidectomy by the same surgeon. They were distributed into Group A (traditional techniques in 468 patients, January 1997 to September 2006) and Group B (Harmonic Ultracision in 419 patients, October 2006 to May 2010).

**Results:** There was a statistically significant lower incidence of complications in Group B (0.95% versus 4.06% in group A): bleeding (0.24% versus 1.92% in group A), tracheostomy (0% versus 1.28%) and intensive care unit stay (0% versus 4.06%). Improvement of surgical activity parameters was also significant for Group B: shorter operation time (60 min versus 180 min), fewer hospital stays (4.62 versus 8.5 stays) and increase in operations per month (9.63 versus 4 interventions). Persistent sequelae (recurrent paralysis [0.48%] and hypoparathyroidism [0.47%]) decreased in the second group but the difference was not statistically significant compared to Group A. The cost per patient was lower in Group B.

**Conclusions:** The Ultracision Harmonic scalpel system is the technique of choice for thyroid surgery.

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### PALABRAS CLAVE

Tiroidectomía;  
Complicaciones;  
Hemostasia;  
Cirugía;  
Bisturí;  
Armónico

### Sistemas de hemostasia en cirugía tiroidea y complicaciones

#### Resumen

**Introducción:** Los avances tecnológicos en hemostasia permiten el sellado vascular con mayor precisión y seguridad que la tradicional ligadura asociada a la electrocoagulación mono o bipolar.

**Objetivo:** Comparar las complicaciones en tiroidectomía total mediante técnicas tradicionales (ligadura, electrocoagulación, incluido Ligasure), frente al uso exclusivo de Harmonic Ultracision que realiza disección, corte y hemostasia simultáneamente.

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E-mail address: [orlblog@orlblog.com](mailto:orlblog@orlblog.com)

**Métodos:** Estudio retrospectivo, descriptivo, comparativo, no aleatorio en 887 pacientes sometidos a tiroidectomía total por el mismo cirujano. Se distribuyeron en grupo A (técnicas tradicionales en 468 pacientes, enero de 1997 a septiembre de 2006) y grupo B (Harmonic Ultracision en 419 pacientes, octubre de 2006 a mayo de 2010).

**Resultados:** En el grupo B se produjeron significativamente menos complicaciones (incidencia global de 0,95 frente al 4,06 en el grupo A): hemorragia (0,24 frente a 1,92% en grupo A), traqueotomía (0 frente a 1,28%) y estancia en UCI (0 frente a 4,06%). Hubo mejora de los parámetros de actividad: menor tiempo quirúrgico (60 frente a 180 minutos), menor estancia hospitalaria (4,62 frente a 8,5 estancias), incremento del número de intervenciones mensuales (9,63 frente a 4 intervenciones). Las secuelas persistentes en el grupo B (parálisis recurrencial -0,48% e hipoparatiroidismo -0,47%) disminuyeron pero sin diferencia estadísticamente significativa respecto al grupo A. El coste por paciente es inferior en el grupo B.

**Conclusiones:** El sistema Harmonic Ultracision es la técnica de elección en cirugía tiroidea.

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## Introduction

Total thyroidectomy is the most commonly performed procedure in endocrine surgery, and like any other surgical procedure, it requires correct haemostasis to avoid intraoperative bleeding, obtain good visualisation of the surgical field and prevent injury to structures such as the parathyroid glands or laryngeal nerves.<sup>1</sup> Haemorrhage, hypoparathyroidism, and recurrent paralysis, although infrequent in experienced centres, are potentially severe.<sup>2</sup>

The solution to these problems has been the concern of surgeons, starting from the pioneers represented by Kocher, who with the improvement of haemostasis, managed to reduce perioperative mortality in thyroidectomy from 60% to 1% in a short period between 1878 and 1888.<sup>3</sup> Technical advances in haemostasis (LigaSure<sup>®</sup> and Ultracision Harmonic<sup>®</sup>) allow vascular sealing with greater precision and safety than the traditional ligation associated with mono- or bipolar electrocoagulation, considered as the reference.<sup>4,5</sup> Initially developed for laparoscopic surgery, their application and implementation in hospitals for thyroid and parathyroid surgery has been uneven, probably due to a high initial cost.<sup>6</sup> The publications report that the use of these devices in thyroid surgery reduces operating time, cost, hospital stay, postoperative pain and the incidence of haemorrhages.<sup>7-9</sup> Their use also enables surgical approaches with smaller cutaneous incisions<sup>9</sup> without increasing the incidence of complications compared with conventional haemostasis techniques.<sup>7-10</sup>

LigaSure<sup>®</sup> is a bipolar vascular sealing system that causes collagen and elastin denaturation in the vessels and surrounding tissues, making haemostasis in vessels up to 7 mm possible<sup>11</sup> and significantly shortening the duration of the technique.<sup>12</sup> The first publications related to thyroidectomy were dated in 2003.<sup>13</sup>

The first citation for Ultracision Harmonic<sup>®</sup> applied to thyroidectomy is from the year 2000,<sup>13</sup> with successive versions.<sup>7</sup> It has been used widely in thyroid, abdominal, thoracic and plastic surgeries.<sup>14</sup> It uses mechanical energy through the vibration of the active branch of the instrument at 55 500 Hz and through its longitudinal displacement that can range from 30 to 100  $\mu\text{m}$ .<sup>15</sup> It produces vascular dissection, cutting and sealing simultaneously<sup>16</sup>; it produces more

coagulation at low energy and has a faster cutting speed at high energy. The mechanical vibration disrupts hydrogen bonds in the tissue proteins at a relatively low temperature (from 37 °C), causing less collateral thermal damage (less than 1.5 mm), up to 10 times lower compared with electrocoagulation or laser (150 at 400 °C).<sup>14,17,18</sup> It produces cavitation in tissue (vaporisation of extra- and intracellular water at 37 °C), coaptation (haemostasis), coagulation (by increasing the temperature to about 63 °C) and cutting (the tissue breaks when it reaches the limit of its elasticity). Collagen and proteoglycans are denatured and, when they mix with intracellular and interstitial fluid, form a gelatinous substance.<sup>7,19</sup> The burst pressure withstood by tissues after the application of the Harmonic in pigs is of 1204 mmHg at 70% power, and of 1193 mmHg at 100%.<sup>19</sup> It is recommended for vessels of up to 6 mm in diameter.<sup>7,11</sup>

The studies are not definitive about the factors that increase the risk of complications in thyroid surgery.<sup>2,20</sup> Intrathoracic goitre, Graves disease and anticoagulant therapy or coagulopathies increase the risk of haemorrhage between 2 and 7 h postoperatively<sup>21-23</sup> (cases of bleeding on the fifth day have been described<sup>24</sup>).

Influencing factors include the type of thyroid disease (thyroid cancer, Graves disease, hyperthyroidism), comorbidity,<sup>25</sup> technique (reoperation, total thyroidectomy or association with lymphadenectomy), thyroid extension (volume, gland weight, substernal extension, invasion of adjacent structures) and the experience of the surgical team.<sup>26</sup> In general, the most complex surgeries are those performed on recurrent thyroids, those with intrathoracic extension and cases of hyperthyroidism.<sup>2</sup>

The aim of this study was to compare complications and surgical activity parameters observed after total thyroidectomy performed exclusively with the Harmonic system versus those observed in patients intervened with conventional scissors dissection techniques and haemostasis by ligation with wire or mono- or bipolar electrocoagulation.

## Materials and Methods

This was a retrospective, descriptive, non-randomised comparative study on 887 patients who underwent total

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