USEFULNESS OF ELECTROSURGICAL TECHNIQUES IN THYROID GLAND SURGERY

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Wide propagation of new generation of electrosurgical devices such as bipolar vessel sealing systems (eg. Thermostapler® by EMED) enabled seamless closing of blood vessels with a diameter up to 7 mm while maintaining the necessary safety margin, as well as reducing the duration of the operation. We decided to verify these reports in our material.

Aim of the study was comparison of thyroid surgery performed with the electrocautery tool – Thermostapler® by EMED with surgery using classic hemostasis technique to evaluate the operative time and complications in the form of bleeding, recurrent laryngeal nerve paralysis, symptoms of hypoparathyroidism, and wound infection.

Material and methods. We retrospectively analyzed 256 patients operated in the Department of General and Proctological Surgery Sołec Hospital in Warsaw due to inert thyroid goitre. All patients underwent total thyroidectomy. Patients were divided into two groups. The first group consisted of 126 patients operated in 2000, using classic techniques of hemostasis. While the second group consisted of 130 patients operated in 2007-2008 with Thermostapler®. We compared duration of surgery and the incidence of postoperative complications.

Results. The operative time was significantly shorter (average 18 minutes) in the second group of patients. We also recorded a statistically significant decrease in the incidence of complications in the group operated with Thermostapler.

Conclusions. Use of bipolar vessel sealing system in a decisive manner shortens the duration of operation. Use of bipolar vessel sealing system also enables a radical reduction in the incidence of complications rate such as bleeding, recurrent laryngeal nerve paralysis, symptoms of hypoparathyroidism, and wound infection. In the future, similar studies should be performed to assess the real costs resulting from the use Thermostapler®.

Key words: thyroidectomy, Thermostapler®, bipolar coagulation

Despite the dynamic advances in conservative treatment of patients with nodular goitre, surgery remains the only effective therapeutic method in thyroid disorders (1). Currently, it is believed that the indications for surgical procedure include neck constriction symptoms in both non-toxic and toxic goitre (2, 3). The absolute indications for surgery encompass thyroid cancer or justified suspicion of neoplastic disease: uncertain results of fine needle aspiration biopsy, recurrent goitre or rapidly growing thyroid tumour (4, 5). On the other hand, failure of applied conservative treatment, contraindications against therapy with radioactive iodine or lack of patient’s consent to such a treatment are among the relative indications (6).
The principles of thyroid surgery have been known since the 1970s, when Emil Theodor Kocher performed the first total thyroidectomy procedure in 1876. Undoubtedly, over the 134 years since that time, significant advances have been made, owing to the development of anaesthetiological and pharmacological methods, as well as continuous improvement in surgical techniques and use of novel equipment, including surgical instruments ensuring effective haemostasis. Thus, an important issue in modern surgery associated with thyroid disorder treatment is the implementation and increasingly wide use of novel electrosurgical (low invasive) surgical techniques. The introduction of classical electrocoagulation has significantly shortened the duration of performed surgical procedures. However, classical electrocoagulation has no application in managing vessels of more than 3 mm in diameter. The introduction of new-generation electrosurgical devices – bipolar vessel sealing systems (e.g. Thermostapler® by Emed, fig. 1) – has allowed suture-free sealing of vessels up to 7 mm in diameter. The core principle of this instrument operation is the creation of intravascular layer of crossing collagen fibres, joining the proper middle coats and sealing the vessel lumen. This is achieved owing to the use of high-frequency low-voltage current and a feedback generator, measuring the delivered voltage and amount of current, and assessing the changes occurring in the tissue. The advantage of such a solution is the achievement of maximum haemostasis with minimum tissue burning, adhesion and charring. The lateral tissue damage is limited to 1-2 cm around the site of heat denaturation (7).

In view of the dynamic growth over the past two decades in the number of performed thyroid surgeries in Poland, and the widespread use of novel equipment ensuring proper haemostasis, it seems pertinent to perform its objective assessment.

The aim of the present study was the comparison of thyroid surgeries performed with the use of electrocoagulation instrument, Thermostapler® by Emed, with those performed by classical methods employing ligatures and underpins, in terms of the procedure duration and complications in the form of haemorrhage, recurrent laryngeal nerve paralysis, hypoparathyroidism symptoms and surgical wound infection.

Fig. 1. Bipolar vessel sealing system – Thermostapler®

MATERIAL AND METHODS

Retrospective analysis was performed on 256 patients undergoing surgical procedure at the Department of General Surgery with Proctology Sub-Unit, Solec Hospital in Warsaw, due to non-toxic goitre. All patients underwent thyroidectomy. The patients were divided into two groups. The first one included 130 individuals (22 males and 108 females; mean age: 50) who underwent surgery in 2000, with the use of classical haemostatic techniques, i.e. ligatures and underpins. The second group encompassed 126 patients (12 males and 114 females; mean age: 54) who underwent surgery in 2007-2008, with the use of Thermostapler®. The characteristics of both groups are presented in tab. 1.

The analysed parameters included the procedure duration and the number of complications in the form of postoperative haemorrhage, recurrent laryngeal nerve paralysis, hypoparathyroidism and surgical wound infection.

RESULTS

The surgical data on the procedure duration are presented in tab. 2. The mean surgery duration differed statistically significantly (p > 0.05) between the two groups, and stood at 113 min in the classical haemostatic technique group and 95 min in the group undergoing thyroidectomy with the application of bicoagulation forceps (Thermostapler®). The results on serious peri- and postoperative complications are presented in tab. 3. The total percentage of complications in the group of patients undergoing thyroidectomy with the use of Thermostapler® was clearly lower and stood at 2.4% as compared with the group of
Table 1. Patient group characteristics

<table>
<thead>
<tr>
<th>Patients (gender, age)</th>
<th>Thermostapler® n=126</th>
<th>Classical technique n=130</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>114</td>
<td>108</td>
<td>NS</td>
</tr>
<tr>
<td>Males</td>
<td>12</td>
<td>22</td>
<td>NS</td>
</tr>
<tr>
<td>Age (years)</td>
<td>54.05 (24-82)</td>
<td>50.24 (17-75)</td>
<td>NS</td>
</tr>
</tbody>
</table>

Table 2. Surgical data

<table>
<thead>
<tr>
<th>Data</th>
<th>Thermostapler® n=126</th>
<th>Classical technique n=130</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery duration (min)</td>
<td>95.26</td>
<td>113.25</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table 3. Peri- and postoperative complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Thermostapler® n=126</th>
<th>Classical technique n=130</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent laryngeal nerve paralysis</td>
<td>0.8% (1)</td>
<td>3% (4)</td>
<td>0.05</td>
</tr>
<tr>
<td>Hypoparathyroidism symptoms</td>
<td>0.8% (1)</td>
<td>1.5% (2)</td>
<td>NS</td>
</tr>
<tr>
<td>Postoperative haemorrhage</td>
<td>0.8% (1)</td>
<td>0.8% (1)</td>
<td>NS</td>
</tr>
<tr>
<td>Surgical wound infection</td>
<td>0%</td>
<td>1.5% (2)</td>
<td>NS</td>
</tr>
<tr>
<td>Total percentage of complications</td>
<td>2.4%</td>
<td>6.8%</td>
<td>0.05</td>
</tr>
</tbody>
</table>

DISCUSSION

Any modification the aim of which is the refinement of surgical procedure, and thus also the improvement of achieved therapeutic results and minimisation of complications, requires analysis. The classical electrocoagulation used to date, having application in sealing of vessels up to 2 mm in diameter only and causing tissue adhesion, burning and charring at 9-15 mm due to uncontrolled destructive heat action, has not been applied widely in thyroid surgery. The result-controlled bipolar electrocoagulation for vessel sealing (including such systems as Thermostapler®, LigaSure® and BiClamp®) is currently more widely used.

patients undergoing surgery with the application of classical haemostatic techniques, where this figure was 6.8%. The following were deemed serious complications: recurrent laryngeal nerve paralysis symptoms, hypoparathyroidism symptoms (confirmed by laboratory tests: lowered blood calcium level), postoperative haemorrhage and surgical wound infection.

Haemostasis was relatively good in the group of patients undergoing surgery with the use of Thermostapler®. There were no cases requiring additional suturing for the management of haemorrhaging vessels (fig. 2 and 3).
in almost all procedural specialisations owing to the possibility of effective and precise dissection and ensuring of thorough haemostasis with the option of sealing vessels up to 7 mm in diameter (8-11). Encouraged by the reports on the advantages of this technology, the authors have decided to assess the safety, effectiveness and efficacy of the Thermostapler® system in thyroid surgery performed at the local centre.

In the present study, the patients undergoing thyroidectomy with the use of the classical method or the Thermostapler® system did not differ significantly in terms of their age, gender or indications for surgery, and the studied groups may be deemed homogeneous. The obtained results indicate a significant difference in the surgical procedure duration between Thermostapler® and classical haemostatic methods (95.26 min vs. 113.25 min). As it transpires, the procedure duration was shorter by 18 min when Thermostapler® was employed, and similar results have been obtained by other surgeons. Shen and colleagues, in a study published in 2005, obtained the procedure duration shorter by 30 min, on average, with the use of bipolar vessel sealing system, while in the group of patients undergoing total thyroidectomy the difference reached 1 h (8). Manouras and colleagues have reported the shortening of procedure duration by 14 min, on average, in a group of patients undergoing surgery with the use of bipolar vessel sealing system (9). Similar results have been obtained by Lepner and Vaasna, Lachanas and colleagues, Petrakis and colleagues, and Alesina and colleagues (10-13). However, not all reports confirm the above findings. Cipolla and colleagues, in a study conducted on a group of 105 patients, published in 2008, did not demonstrate any statistical differences in the procedure duration between the bipolar vessel sealing system and the classical haemostatic techniques (14). Moreover, Cipolla and colleagues did not find any differences in the percentage of complications between the studied patient groups (14).

In the present study, a statistically significant difference was found between the total percentages of complications in the studied groups. In patients undergoing strumectomy with the use of Thermostapler®, the above figure was clearly lower and stood at 2.4% as compared with patients undergoing surgery with the use of classical haemostatic methods, where it was 6.8%. In the present study, the largest reduction, which was statistically significant, was observed in complications in the form of recurrent laryngeal nerve paralysis. The prevalence of other complications (hypoparathyroidism symptoms, postoperative haemorrhage and surgical wound infection) did not differ between the two studied groups. Similar results have been obtained by Petrakis and colleagues who have also noted a drop as regards all the studied complications post thyroid surgery in a group of patients undergoing the procedure with the use of bipolar vessel sealing system (12). Lepner and Vaasna, and Parmeggiani and colleagues, additionally report a reduction in hypoparathyroidism among patients undergoing surgery with the use of LigaSure® vessel sealing system (LVSS) (10, 15). The above is most likely owing to one of the characteristics of controlled bipolar electrocoagulation, i.e. the limitation to 1.5-2 cm of the range of heat action on surrounding tissues. However, not all publications report a drop in the number of complications: Saint Marc and colleagues have demonstrated a total percentage of complications at 35% (including transient complications) and no statistically significant difference between the group undergoing surgery with the use of LVSS and the one with a classical technique (16).

An important feature of the Thermostapler® system is the option of sterilising the bicoagulation forceps, and thus the possibility of their repeated use. The above and the definite reduction in the amount of used suture during the procedure might provide an economic advantage from the use of this tool. However, the publications are inconsistent on the issue. Saint Marc and colleagues have reported that the cost of a single procedure with the use of LVSS increased by EUR 45 as compared with classical haemostatic techniques (16). An increase in the costs of thyroid surgery with the use of LVSS has also been noted by Cipolla and colleagues (14). On the other hand, Pons and colleagues have observed a reduction in the costs of a single surgical procedure with the use of LVSS by USD 11 as compared with the control (“classical” method), and a clear drop by USD 85 in a group undergoing surgery with the use of harmonic scalpel (17). It seems that, taking into account the total costs associated with hospi-
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CONCLUSIONS

1. The use of bipolar vessel sealing system definitely (statistically significantly) reduces the surgical procedure duration.
2. The use of bipolar vessel sealing system provides a radical (statistically significant) reduction in the incidence of complications post thyroid surgery.
3. It is indicated to expand in future the above studies by the economic aspect – the comparison of costs of thyroid surgery employing Thermostapler® with that using classical haemostatic techniques.

REFERENCES