The influence of diagnostic procedures on the most successful surgical management of thyroid diseases

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Abstract Objective: To determine the value of different diagnostic procedures in obtaining the most accurate pathomorphologic diagnosis in order to help the surgeon perform the most appropriate extent of thyroid resection.

Design: A retrospective study of 586 patients who underwent thyroid resection in a 10 year period from January 1, 1983 to December 31, 1993. The value of a particular diagnostic procedure for the correct decision was evaluated by comparison of groups of patients using chi-square \( x^2 \) (\( p = 0.05 \)). The value of fine needle aspiration cytology (FNAC) for correct diagnosis was evaluated by Galen-Gambino using its specificity, sensitivity and accuracy.

Setting: Teaching hospital in Slovakia.

Subjects: Patients with thyroid diseases who presented themselves to the general surgical unit.

Main outcome measures: To determine the influence of different preoperative diagnostic procedures (clinical investigation, fine needle aspiration cytology, frozen section) on the surgeon's decision to make and provide the correct extent of resection and on the clinical outcome and operative complications.

Results: 1. A comparison of direct influence of three different preoperative diagnostic procedures on the main outcome showed a significant difference (\( p < 0.05 \)) in favor of FNAC in choosing the most accurate extent of resection and in terms of clinical outcome. No significant difference among the diagnostic procedures was found in the rate of postoperative complications (\( p > 0.05 \)). 2. A comparison of two groups of patients with or without FNAC as a single diagnostic procedure showed a significant difference in terms of the most accurate surgical resection (\( p < 0.05 \)) but there was no significant difference in the clinical outcome and the rate of operative complications (\( p > 0.05 \)). 3. A significant difference allowing a correct extent of resection (\( p < 0.05 \)) was also proved in favor of preoperative FNAC in the group of patients with toxic goiter. 4. A significant difference (\( p < 0.05 \)) was proved also in the group of patients for whom FNAC specified exactly, also precancerous (Hürte and atypical adenoma) compared to the group where only benignity and malignancy were distinguished. 5. FNAC in a group of patients with follicular lesion had sensitivity 87.5%, specificity 98.3% and accuracy 97.0%. 6. The sensitivity of frozen section for malignancy in our study was 71.4%, specifically 85.7%, accuracy 77.8%, the positive predictive value 83.3% and the negative predictive value 73.3%.

Conclusion: According to our results we strongly recommend fine needle aspiration cytology as a routine preoperative investigation in all thyroid nodules including toxic goiters. Our results confirm that FNAC can identify precancerous lesions as well as identify between benign and malignant follicular lesions. Surgeons should use frozen section in cases of uncertain FNAC but should not rely on its negative result.


KEYWORDS: Thyroid diseases, FNAC, frozen section.

There are many different preoperative diagnostic procedures and they are not all of equal value to the surgeon when he is choosing the best operative strategy. Each histopathological process in the thyroid requires a specific extent of resection. Therefore, it is necessary for a surgeon to know exactly what the pathology in the thyroid is so that he is able to perform an adequate extent of resection. We evaluated different diagnostic procedures to find out which procedure helped the surgeon most of all to perform the right extent of resection of the thyroid. Moreover, there are still doubts about performing FNAC in toxic goiters where the incidence of carcinoma is low, and the value of the frozen section, for a precancerous lesion is sometimes difficult for the pathologist to evaluate.

Materials and Methods We evaluated 586 patients who underwent thyroid resection at the F.D. Roosevelt Hospital from January 1, 1983 to December 31, 1993. There were 76 men (13%) and...

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510 women (87%) with the average age being 49 years (6 to 85). Three hundred and seventy-five patients (64%) presented with toxic and 211 (46%) with nontoxic goiter. Complete clinical evaluation was performed on 586 patients (scintigraphy, laryngoscopy, upper thoracic outlet and x-ray). Fine needle aspiration cytology was preoperatively performed in 335 patients (57.1%). In 27 patients intraoperative histology (frozen section) was performed. In 249 patients the surgeon decided to perform surgical procedure (extent of resection) according to the result of clinical evaluation. The FNAC determined the surgeon’s decision in 310 patients and the frozen section in 27 patients. Definitive histological results are shown in Table 1. We evaluated the influence of different diagnostic procedures on the surgeon’s decision to perform an adequate extent of resection.

<table>
<thead>
<tr>
<th>Histological results</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign colloid or follicular nodule</td>
<td>375</td>
<td>64.0</td>
</tr>
<tr>
<td>Cyst</td>
<td>31</td>
<td>5.3</td>
</tr>
<tr>
<td>Atypical adenoma</td>
<td>14</td>
<td>2.4</td>
</tr>
<tr>
<td>Hürthle adenoma</td>
<td>30</td>
<td>5.2</td>
</tr>
<tr>
<td>Hashimoto’s thyroiditis</td>
<td>14</td>
<td>2.4</td>
</tr>
<tr>
<td>Riedl’s fibrothik thyroiditis</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Adenoma with hormonal activity (clinically toxic)</td>
<td>28</td>
<td>4.7</td>
</tr>
<tr>
<td>Basedow-Graves goiter</td>
<td>33</td>
<td>5.6</td>
</tr>
<tr>
<td>Papillary carcinoma</td>
<td>33</td>
<td>5.6</td>
</tr>
<tr>
<td>Follicular carcinoma</td>
<td>7</td>
<td>1.2</td>
</tr>
<tr>
<td>Medullary carcinoma</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td>Anaplastic carcinoma</td>
<td>11</td>
<td>1.8</td>
</tr>
<tr>
<td>Spinoepithelial carcinoma</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>Metastasis to the thyroid</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>586</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

According to this algorithm the surgeon decided correctly in 524 patients (89.7%) and in 62 patients (10.3%) the procedure was incorrect. Either he underestimated the extent of surgery required which resulted in him having to reoperate and complete the procedure, or the procedure was too radical. It was considered a good clinical result, if the patients were without a recurrent goiter or toxic symptoms, or had no signs of hypothyrosis six months after operation. Hypothyrosis after total thyroidectomy for carcinoma was not considered a bad clinical result. The complications we considered were paresis of recurrent nerve and clinical evidence of hypoparathyroidism (tetania parathyropriva). The importance of particular diagnostic procedures which led to the surgeon’s correct decision (choosing the adequate extent of resection) were evaluated by comparison of groups of patients using chi-square x² (p = 0.05). The value of FNAC for the correct diagnosis was evaluated by Galen-Gambino using its sensitivity, specificity and accuracy.

**Results**

1. The influence of the different preoperative diagnostic procedures on the surgeon’s decision-making, clinical outcome and operative complications:

According to clinical findings, (without FNAC) the surgeon decided to operate on 249 patients. In this group of patients an adequate surgical procedure was chosen in 186 patients (74.4%), good clinical results were achieved in 202 patients (80.7%), and complications occurred in 23 patients (9.2%).

The results of FNAC led the surgeon to make his decision in 310 cases. In this group of patients adequate surgical procedure was chosen in 290 patients (93.4%), good clinical results were achieved in 274 patients (88.4%), and complications occurred in 15 patients (4.8%).

The result of frozen section led the surgeon to decide to operate on 27 patients. In this group of patients an adequate surgical procedure was chosen in 21 patients (74.8%), good clinical results were achieved in 21 patients (74.8%), and complications occurred in 2 patients (7.4%).
There was a significant difference in favor of decisions taken on the evidence of FNAC (p < 0.05) compared to other diagnostic procedures. There was a significant difference in favor of FNAC on the clinical outcome (p < 0.05) and no significant difference among the diagnostic procedures on the rate of complications (p > 0.05).

2. The importance of preoperative FNAC investigation: In the group of patients where FNAC was performed preoperatively (335 patients), the surgeon performed an adequate extent of resection in 312 patients (93.1%), a good clinical outcome was achieved in 285 patients (85.0%), and operative complications occurred in 27 patients (8.0%). In the group of patients where FNAC was not carried out preoperatively (251 patients), the surgeon performed the correct extent of resection in 213 patients (85.0%), good clinical outcome was achieved in 206 patients (82.0%) and operative complications occurred in 20 patients (8.0%). There was a significant difference in the correctness of the surgeon’s decision (p < 0.05) but no significant difference in the clinical outcome and rate of operative complications (p > 0.05). As the postoperative clinical outcome and occurrence of the operative complications are determined by the surgeon’s personality and experience, we divided surgeons into four groups with a significantly different rate of operative complications (laryngeal, nerve, and parathyroid gland injury and postoperative hypothyroidism). The group with the lowest rate of operative complications and postoperative hypothyroidism, performed 79% of all operations (440) and can be considered a standard group of the most experienced surgeons with the lowest influence of a lack of surgeon’s experience on the clinical outcome and complications. Among patients operated on by standard group of surgeons: in the group where FNAC was carried out preoperatively (264 patients), in 241 patients (91.2%) a good clinical result was achieved and operative complications occurred in 14 patients (5.2%). In the group where FNAC was not carried out (176 patients) a good clinical outcome was achieved in 145 patients (82.1%) and complications occurred in 9 patients (5.1%). There was a significant difference in the clinical outcome (p < 0.05) in favor of the group with FNAC, but not a significant difference in the rate of operative complications (p > 0.05).

3. The influence of preoperative FNAC investigation in toxic goiter cases: In the group of toxic goiters where FNAC was preoperatively performed (175 patients), the surgeon performed the correct extent of resection on 165 patients (94.2%), in the group where FNAC was not done (200 patients), the correct extent was performed on 169 patients (84.5%). There is a significant difference in favor of the group with FNAC (p < 0.05).

After the elimination of the influence of surgeon’s experience (281 patients with toxic goiter operated on by a standard group of surgeons was evaluated) a good clinical outcome was achieved in 92.1% (154 out of 168 patients) in the group with FNAC compared to 79.6% (90 out of 113) in the group without FNAC. The difference is significant (p < 0.05). Operative complications occurred in 4.2% (7 out of 168 patients) in the group with FNAC compared to 4.4% (5 out of 113 patients) in the group without FNAC. The difference is not significant (p > 0.05).

4. The importance of precise specifications of cytological findings: We compared the group of patients for whom FNAC specified benign, malignant lesions or precancerous (Hürthle and atypical adenoma) and the group for whom FNAC distinguished only between benign or malignant lesions. In the group where cytologists correctly specified cytological findings (205 patients investigated by cytopathologists of F.D. Roosevelt Hospital), the surgeon performed the correct extent of resection in 188 patients (92.2%). In the group where cytologists distinguished only between benignancy and malignancy (135 patients investigated by other cytologists outside the F.D. Roosevelt Hospital) the surgeon performed the correct extent of resection in 110 patients (81.5%). There is a significant difference in favor of the group in which cytologists distinguished precancerous lesions (p < 0.05).

5. Specification of follicular lesions: From all 101 histologically confirmed follicular lesions, 67 were preoperatively investigated with FNAC by cytopathologists in F.D. Roosevelt Hospital. The criteria used for distinguishing between benignancy and malignancy were as follows: The follicular adenoma had follicular formation with coarse colloid and cells with the radial axis and cytological signs of benignity. The follicular carcinoma had follicular formation with central colloid and cells with circumferential axis and cytological signs of malignancy. From 8 histologically proven follicular carcinomas, 7 were specified from cytology correctly. From 59 histologically proven follicular adenomas, 58 were specified from cytology correctly. Fine needle aspiration cytology for follicular lesions in our cases had sensitivity 87.5%, specificity 98.3% and accuracy 97.0%.

6. The value of frozen section: In 27 patients a
frozen section was performed. Out of 12 patients intraoperatively considered as malignant, in 10 patients this was proved also from definitive histology. Out of 15 patients intraoperatively considered as benign, in 11 patients this result was proved from definitive histology. The sensitivity of the frozen section for malignancy in our cases was 71.4%, the specificity 85.7%, the accuracy 77.8%, the positive predictive value 83.3% and the negative predictive value 73.3%.

Discussion We composed the algorithm of the correct extent of resection on the thyroid according to the literature data commonly accepted among surgeons.\textsuperscript{1,2,3,4,5} If the surgeon does not choose the correct surgical procedure, later he must reoperate to complete the resection, or he performs an unnecessarily radical procedure. In both cases there is a higher risk of damage to the laryngeal nerve and to the parathyroid glands. Moreover, the reoperation adds to the psychological trauma for the patient. Comparing the influence of different diagnostic procedures on the surgeon's decision-making we found that the diagnostic procedure which can help the surgeon most of all to perform the correct procedure is FNAC. This is commonly accepted.\textsuperscript{6,7,8,9} Fine needle aspiration cytology has an influence also on the clinical outcome of the operation. The rate of operative complications depends more on the surgeon's experience than on preoperative diagnostic procedures. There are some doubts about whether to perform FNAC on toxic goiter cases where the incidence of malignancy is low. We also found that in toxic goiters FNAC plays an important role in the correct surgeon's decision-making and in the consecutive clinical outcome. Our results confirm that it is necessary to specify from cytology not only between benign and malignant lesions but also to specify precancerous (Hürthle and atypical adenomas). This allows the surgeon to perform the correct extent of resection in a significantly higher number of patients. The most problematic question is whether it is possible to differentiate between benign and malignant follicular lesions through cytology. Many authors are of the opinion that it is impossible\textsuperscript{10,11} but other authors claim that it is possible and they give their own criteria.\textsuperscript{12,13} Our results confirm that distinguishing between benign and malignant follicular lesions is possible and it is of great value to the surgeon (the accuracy was 97%). The frozen section is a reliable method as far as positive results for carcinoma are concerned (positive predictive value is 83.3%) but negative results are not reliable because of the low sensitivity\textsuperscript{14,15} which in our material was 71.4%.

Conclusion According to our results, we recommend fine needle aspiration cytology as a routine preoperative investigation in all thyroid nodules, including toxic goiters. Our results confirm that from FNAC it is also possible to specify precancerous as well as to distinguish between benign and malignant follicular lesions. Surgeons should use the frozen section in cases of uncertain FNAC results, but should not rely on the negative result of a frozen section.

Summary A review of 586 patients who underwent thyroid gland operation at the Department of Surgery F.D. Roosevelt Hospital in Banská Bystrica during 1983-1993 showed that from all diagnostic procedures FNAC can help the surgeon to perform the correct extent of resection better than any other procedure. Performing this procedure preoperatively leads to a better postoperative clinical outcome. Fine needle aspiration cytology proved its value also in cases of toxic goiter. Sensitivity 87.5% of FNAC in follicular lesions shows that it is possible to differentiate between benign and malignant follicular lesions. Frozen section is reliable in cases of positive results but surgeons cannot rely on its negative result because of its low sensitivity (71.4%).

References

الخلاصة:
الأهداف:
تحديد قيمة طرق التشخيص المختلفة في الحصول على أكبر التشخيصات الشكلية دقة لمساعدة الجراح في إجراء أكثر مدى مناسب
لاستخدام الغدة الدرقية.

التوصيف:
دراسة إسترجاعية تشتمل على وثمانون مرضا أجريت لهم جراحة استئصال الغدة الدرقية في فترة عشر سنوات من 1 يناير
1983 حتى 31 ديسمبر 1993. قيمة أي إجراء تشخيصي محدد بالنسبة للقرار الصحيح من حيث مدى الاستعمال قدرت
مقارنة مجموعات المرضا باستخدام (0.05) (P<) Chi-Square x²
بأسلب جالن - جاميوتو لبيان دقتها وحساسيتها ومداها.

المكان:
مستشفى جامعي في سلوفاكيا.

الموضوع:
مرضى أمنيات الغدة الدرقية الذين قدموا بأنفسهم لوحدة الجراحة العامة.

قياسات النتائج الرئيسي:
نتحديد تأثير الإجراءات التشخيصية المختلفة قبل الجراحة (ال اختبارات الأكليبيكية، فحص الخلايا المبزولة بأبرة رفيعة والمقطع
المتاج) على قرار الجراح لإجراء الحد الأدنى للاستعمال على النتائج الأكليبيكية والمضاعفات الجراحية.

النتائج:
1) مقارنة النتائج لثلاثة إجراءات تشخيصية مختلفة قبل الجراحة على النتائج الرئيسية أظهرت اختلاف هام لصالح فحص
الخلايا المبزولة بأبرة رفيعة في اعتبار أكثر حدود الاستعمال دقة على مستوى النتائج الأكليبيكية. لا يوجد اختلاف هام بين الإجراءات
التشخيصية في تحديد نسبة الضحايا بعد الجراحة.

2) مقارنة مجموعات المرضا مع أو بدون فحص الخلايا المبزولة بأبرة رفيعة كإجراء وحيد تشخيصي أو مؤثر اختلاف هام لتحديد
دقة الاستئصال الجراحي لنفس لا يمكن هناك اختلاف هام في النتائج الأكليبيكية أو نسبة المضاعفات الجراحية.

3) نتائج اختلاف هام يظهر التحديد الصحيح للاستعمال فحص الخلايا المبزولة بأبرة رفيعة قبل الجراحة في مجموعة
مرضى أمنيات الغدة الدرقية.

4) كما تبين أيضاً اختلاف هام في مجموعة المرضا الذين حدد لهم فحص الخلايا المبزولة بأبرة رفيعة تشخيصي ورم مريض بالمقارنة
بالمجموعة التي تمت فيها ما إذا كان الورم حسيما أو حبيباً.

5) كان النتائج الخلايا المبزولة بأبرة رفيعة في مجموعة المرضى المصابين بآفة التكيس حساسية بنسبة 58.2٪ وخصوصية بنسبة
78.6٪ ودقة بنسبة 71.3٪.

6) كانت حساسية المقطع المتاج لتحديد خث العينة في دراستنا 71.8٪ وكانت نسبة خصوصيتها 85.7٪ ونسبة دقتها 77.8٪.

وقد كان معدل التوقع الإيجابي 82.3٪ أما معدل التوقع السلبي فكان 73.3٪.

الخلاصة:
بناء على نتائجنا فإن نقص نصب بشدة بعث يحمى فحص الخلايا المبزولة بأبرة رفيعة رونتينيا قبل الجراحة لكل حالات العدد
في الغدة الدرقية وكذلك حالات التورم الدرقي التوكسيبي. نتائجنا أثبتت ضرورة تحديد ما قبل الاصابة بالسرطان وكون الآفات المتجمسة
تحذير من طريق فحص الخلايا المبزولة بأبرة رفيعة. يجب على الجراح أن يستعمل المقطع المتاج في الحالات التي لا يوجد فيها
فحص الخلايا المبزولة بأبرة رفيعة لكن لا يجب الاعتماد على نتائجه السلبية.