each patient was subjected to an additional puncture. This diagnostic technique is not without possible complications, and although the problems are usually mild and infrequent, the fact of subjecting a patient to additional punctures may lead to an increased risk of complications.

With regard to our own experience, a description is provided below of the learning curve obtained in our center in a high-resolution thyroid nodule unit. It should be noted that we only analyzed punctures in patients who had not undergone prior punctures performed by the endocrinologist, thereby discarding second punctures made after an invalid puncture result (Bethesda I) versus the rest (Bethesda II or higher).

Fig. 1 shows that the curve stabilizes in our study from puncture 70–80, and continues to show an improvement between puncture 60 and the subsequent punctures. Of note is the fact that the percentage of FNAB procedures with cumulative valid results did not reach 80% (the percentage being around 73%).

A number of limitations may be found in our sample, the most important being the diversity of pathologists analyzing the samples (6 in total). This constituted one of the strengths of the paper published by Penín et al., controlling for one of the potential effect-modifying factors, though no differences were noted in our analysis due to the diversity between pathologists and the cytology results.

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Learning curve of thyroid fine-needle aspiration citology in a thyroid nodule clinic☆

Curva de aprendizaje de la punción-aspiración con aguja fina en una unidad de tiroides

Dear Sir,

We have read with interest the article published in *Endocrinología, Diabetes y Nutrición* by Manuel Penín et al. on the learning curve of ultrasound-guided thyroid fine needle aspiration biopsy (FNAB) in the hands of a specialist in endocrinology.[1] The authors present an analysis of the learning curve of FNAB, comparing the results obtained by an experienced endocrinologist versus those of an inexperienced colleague. The main conclusion of the study is that the technique can be adequately mastered after approximately 60 FNAB procedures involving two punctures each, and performed over 8 clinical working days.

As the article itself recognizes, there is not enough published evidence on this matter. In this respect, it is good news that there are efforts such as the present study, capable of shedding more light on a technique that is gradually being adopted by endocrinologists in our setting.[2] However, in our opinion, the results and conclusions derived from the aforementioned study differ from the prevalent experience of any specialist who has acquired learning in ultrasound-guided FNAB, as well as from the results published by some of the pioneering thyroid units in Spain.[2–4]

Fig. 1 shows the number of punctures performed and the 6-monthly evolution of the percentage of inadequate samples for diagnosis obtained by ultrasound-guided FNAB since the inauguration of the thyroid unit at our center in 2009. The results referring to the learning curve were analyzed using the SPSS® version 20 statistical package.
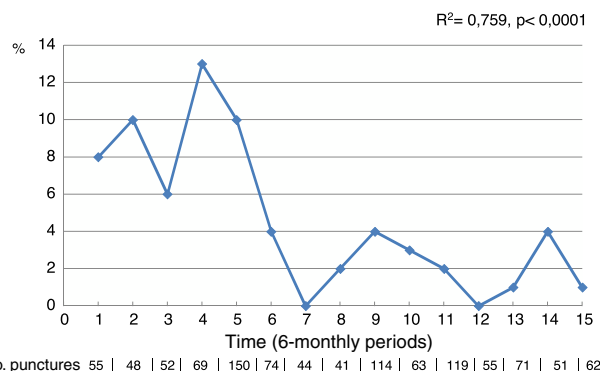
$R^2 = 0,759$, $p < 0,0001$

| No. punctures | 55 | 48 | 52 | 69 | 150 | 74 | 44 | 41 | 114 | 63 | 119 | 55 | 71 | 51 | 62 |

Figure 1 Porcentaje insuficientes para diagnóstico. Periodo 2009–2016.

A curved estimation regression model was developed, as the best fit corresponding to the square regression model, previously described in the evaluation of learning curves in other settings.[5] The results reflect the learning curve of an endocrinologist with no prior experience in FNAB over a 7-year period. A strong correlation was seen, with a decrease in the percentage of inadequate samples as skill was acquired in performing the technique ($R^2 = 0.759$; $p < 0.0001$). Nodular disease assessed during the period 2009–2016 was not previously selected, and the cases were referred to the thyroid unit of our center for FNAB by the endocrinologist. Although the complexity of the punctures performed increased over time as further skill was gained, the results reflect the reality of clinical practice in a unit of this kind. These results are more demanding than those proposed by Penin et al. regarding both the learning period and the required number of FNAB procedures.

Although the percentage of cytological cases with a Bethesda I result was <20% from the start, there is a clear learning curve with a point of inflection at two and a half years of experience and after more than 350 performed punctures. From that time onwards, the mean percentage of samples insufficient for diagnosis was seen to be 2.1% in the period 2012–2016, even with 6-monthly periods in which there were no samples classifiable as Bethesda I. The results during this second cycle afforded maximum diagnostic yield and efficiency of ultrasound-guided FNAB, as previously reported by our group.[3,6] From this perspective, and as opposed to the observations of Penin et al., a cut-off percentage of insufficient samples of <20% for defining FNAB as adequate is too high, and results in a very high repetition of samples and diminished efficiency. Although inadequate samples for diagnosis have been reported in 2–20% of the cases, the Bethesda System for Reporting Thyroid Cytopathology acknowledges that ''these should be limited to no more than 10% of the thyroid FNABs''.[7,8] The criterion may be even more demanding in situations where the consequences of an inadequate technique could lead to patient risk, such as in the monitoring of thyroid cancer and FNABs of suspicious adenopathies.[9]

In sum, although we fully agree on the need for training of specialists in endocrinology and nutrition in ultrasound imaging and its related techniques, we believe that the technical difficulty involved should not be underestimated, though the theoretical bases of the procedure can be assimilated within a few days. Furthermore, such difficulty in the learning of ultrasound and the need for training is not exclusive to ultrasound-guided techniques (FNAB, cyst enolization, minimally invasive procedures, etc.), but is an inherent part of the basic and elemental assessment of cervical ultrasound images and their characteristic suspected disease patterns.[9] As in other specialties,[10] the training of future specialists in endocrinology and nutrition requires adequate time and dedication, because the results obtained will condition the final implementation of the technique by endocrinologists in this country.

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