Letter to the editor regarding residual vital ratio: predicting regrowth after radiofrequency ablation for benign thyroid nodules

To the Editor,

We read the authors’ study ‘Residual vital ratio: predicting regrowth after radiofrequency ablation for benign thyroid nodules’ with great interest [1]. This study is valuable in that it introduces a novel quantitative index named as the residual vital ratio (RVR) after radiofrequency ablation (RFA) of symptomatic benign thyroid nodules. It is practical by far for the following-up of three volumes after RFA: total nodule volume (Vt), ablated volume (Va), and viable volume (Vv) [2]. In addition, by using contrast-enhanced ultrasonography (CEUS), useful clinical information was derived. We commend the authors for their clinical effort and research. In this study, the authors described that the RVR represents how well the RFA procedure was performed and could be an early quantitative predictor for nodule regrowth. If the RVR was larger than 44.5%, the treated nodule tended to regrow.

RVR as an index indicating the performance of the procedure: comparison with IAR

The authors stated that the RVR was the initial ratio of the residual vital volume to the total volume after RFA and calculated the RVR with the following formula: \( \text{RVR} = \frac{\text{Vv}}{\text{Vt}} \times 100 \) [%] [3]. To compare two similar concepts, we introduce a simple example. A 10 ml nodule was treated by RFA. A total of 9 ml was ablated, and 1 ml remained as the untreated viable residual volume. Here, we can say that \( \text{Vt}(0) = 10 \text{ ml}, \text{Va}(0) = 9 \text{ ml}, \text{and Vv}(0) = 1 \text{ ml} \). The number inside the parenthesis indicates the time in months after RFA. (0) represents the time immediately after RFA. In this case, \( \text{IAR} = \frac{\text{Va}(0)}{\text{Vt}(0)} = 9 \text{ ml}/10 \text{ ml} = 90\% \). IAR = 90% indicates the ablation of 90% of the nodule volume during the RFA procedure, and 10% of the nodule volume remains untreated.

If there was a 3 ml volume reduction after 1 month, then \( \text{Vt}(1) = 7 \text{ ml}, \text{Va}(1) = 6 \text{ ml}, \text{and Vv}(1) = 1 \text{ ml} \). In this case, \( \text{RVR} = \frac{\text{Vv}(1)}{\text{Vt}(1)} = 1 \text{ ml}/7 \text{ ml} = 16\% \). An RVR of 16% indicates that 16% of the nodule tissue remained viable at 1 month after treatment, and 84% of the tissue was ablated.

The concepts of the IAR and RVR are very similar; however, the denominator is different (\( \text{Vt}(0) \) or \( \text{Vt}(1) \)). In the example above, the IAR intuitively indicates that 90% of the nodule tissue has been ablated through the procedure. As the RVR is 16%, it suggests that 84% of the nodule tissue has been ablated, which is different from the performance at the time of the procedure. In the case of better treatment effects, such as \( \text{Vt}(1) = 5 \text{ ml}, \text{Va}(1) = 4 \text{ ml}, \text{and Vv}(1) = 1 \text{ ml} \), RVR = 20%, and the performance will appear worse.

On the other hand, the IAR is a little more complex. As \( \text{Va}(0) \) cannot be measured immediately after the procedure, the formula \( \text{IAR} = \frac{\text{Va}(0) - \text{Vv}(1)}{\text{Vt}(0)} \) is used. As a result, \( \text{IAR} = \frac{\text{Va}(0)}{\text{Vt}(0)} - \frac{\text{Vv}(1)}{\text{Vt}(0)} \). It is slightly easier to obtain the RVR using \( \text{Vv}(1) \) and \( \text{Vt}(1) \) measured at 1 month. However, as \( \text{Vv}(1) \) is not measured directly, it also is calculated indirectly through \( \text{Vv}(1) = \text{Vt}(1) - \text{Va}(1) \). As a result, \( \text{RVR} = \frac{\text{Vt}(1) - \text{Va}(1)}{\text{Vt}(1)} \).

The RVR has some of these disadvantages; however, what are the advantages? We also request your opinion on what types of problems are associated with the IAR.

RVR as an early sign of regrowth: comparison with IAR and 12-month VRR

Regrowth and additional treatment are important topics of interest, which have only been mentioned in a few international guidelines [4]. The authors claimed that they could predict regrowth occurring at 20.77 ± 12.03 months using the RVR, an index that can be obtained at 1 to 3 months after the procedure; thus, the RVR may be an early predictor of regrowth. There have been similar studies previously. In a study by Negro et al. who retrospectively analyzed the results of 5-year follow-up after laser ablation, a 12-month VRR < 50.0% is a predictive risk factor for regrowth and correlates with the time to regrowth [5]. In addition, Sim and Park observed that the IAR is linearly correlated with the 12-month VRR, and if IAR < 70%, it can be used for the early prediction of regrowth [6,7]. The RVR along with the IAR and 12-month VRR can quantitatively show that if the ratio of the ablated volume to the nodule volume is insufficient, there is a possibility of future regrowth; thus, it must be an important predictive factor for regrowth. Clinically, regardless of which criterion is used, such as IAR < 70%, RVR > 44.5%, and 12-month VRR > 50%, if ablation is insufficient, there is a possibility of regrowth; thus, a closer follow-up is required. If Vv regrowth is noted, it is suggested that an additional session of ablation should be planned for the upcoming regrowth. I ask the authors to comment on this.

In conclusion, the RVR reflects the performance of the RFA procedure. However, compared with the IAR, there is an error in quantifying the performance using \( \text{Vt}(1) \) instead of \( \text{Vt}(0) \). The RVR is an important predictive factor for regrowth, and it is expected to be clinically useful, similar to the previously announced IAR or 12-month VRR.

Disclosure statement

No potential conflict of interest was reported by the author(s).
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