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British Journal of Oral and Maxillofacial Surgery xxx (2016) xxx–xxx

BRITISH  
Journal of  
Oral and  
Maxillofacial  
Surgery[www.bjoms.com](http://www.bjoms.com)

# Complications after fine-needle aspiration cytology: a retrospective study of 7449 consecutive thyroid nodules

C. Cappelli<sup>a,\*</sup>, I. Pirola<sup>a</sup>, B. Agosti<sup>a</sup>, A. Tironi<sup>b</sup>, E. Gandossi<sup>a</sup>, P. Incardona<sup>b</sup>, F. Marini<sup>a</sup>, A. Guerini<sup>b</sup>, M. Castellano<sup>a</sup>

<sup>a</sup> Department of Medical and Surgical Sciences, Endocrine and Metabolic Unit, University of Brescia, Clinica Medica—2<sup>a</sup> Medicina Spedali Civili di Brescia, 25100 Brescia, Italy

<sup>b</sup> Department of Pathology, Spedali Civili di Brescia, 25100 Brescia, Italy

Received 18 August 2016; accepted 22 November 2016

## Abstract

Although fine-needle aspiration (FNA) cytology of thyroid nodules is invasive, it is simple, reliable, safe, and well-accepted by patients. Local pain and minor haematomas are the most common complications, and serious ones are rare. We report the complications associated with ultrasound-guided FNA of 7449 thyroid nodules in a series of 6323 patients (5121 women and 1202 men) treated between January 2007 and March 2016 at our institution. We reviewed their medical and imaging records, and recorded the number and type of complications, time of detection, time to recovery, management, and permanent consequences. Ten patients (0.15%) had complications, which included a focal carotid intramural haematoma that spread along the carotid wall for 7 cm in a young patient, and one case of tumour seeding. No complications caused permanent problems. This series shows that ultrasound-guided FNA of thyroid lesions is safe and has few complications. However, physicians should always consider the risks and benefits for each patient before the procedure.

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**Keywords:** thyroid nodule; fine-needle aspiration cytology; adverse effects

## Introduction

Fine-needle aspiration (FNA) of thyroid nodules was first reported in Sweden in the 1950s but it was not used widely until the 1980s.<sup>1,2</sup> There are several methods, but the most efficient uses ultrasound guidance with 21–27-gauge needles and aspiration with a syringe or capillary action. FNA is currently the most simple, accurate, safe, and cost-effective method of identifying malignant thyroid nodules,<sup>3–5</sup> and

although invasive, is well-accepted by patients. The most commonly reported complications are local pain and minor haematomas; serious ones are rare.<sup>6</sup> However, these data can be questioned, as they are derived from studies with small numbers or from series that report needle aspiration guided by palpation or by different techniques.<sup>6</sup> The purpose of this study therefore was to report the complications associated with ultrasound-guided FNA of thyroid lesions in a large series of patients treated at the same institution.

## Material and methods

We reviewed the medical and imaging records of patients who had ultrasound-guided FNA of thyroid nodules at

\* Corresponding author at: Department of Medical and Surgical Sciences, Endocrine and Metabolic Unit, University of Brescia, c/o 2 Medicina Spedali Civili di Brescia, Piazzale Spedali Civili n°1, 25100 Brescia, Italy. Tel.: +390303995251.

E-mail address: [carlo.cappelli@unibs.it](mailto:carlo.cappelli@unibs.it) (C. Cappelli).

<http://dx.doi.org/10.1016/j.bjoms.2016.11.321>

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our institution between January 2007 and March 2016. We used a LOGIQ 9 (GE, Healthcare, Milwaukee, WI, USA) or Aplio™ 500 (Toshiba Medical Systems Corp, Otawara, Japan) ultrasonographic scanner equipped with a 10–14-MHz linear transducer for morphological study. All ultrasound examinations and ultrasound-guided FNA were done by two endocrinologists experienced in these procedures (CC and IP).<sup>7–9</sup> Samples were obtained by capillary action using 25-gauge needles, and three passes were made/nodule. After insertion into the nodule, the needle was moved back and forth several times with a rapid, gentle, stabbing motion. To minimise the risk of bleeding, and in accordance with our protocol, patients stopped taking anticoagulants five days before the procedure, and stopped taking aspirin or clopidogrel bisulphate three days before and for three days afterwards.

We recorded the number and types of complications, time of detection, time to recovery, management, and permanent problems. A serious complication was considered to be one that led to substantial morbidity and disability, which increased the level of care, resulted in admission to hospital, or lengthened the hospital stay, in accordance with the definition by the Society of Interventional Radiology.<sup>10,11</sup> All other complications were considered minor.

The Review Board at our institution approved the study. All patients had given their written informed consent before the procedure.

### Statistical analysis

Statistical analyses were done with the help of IBM SPSS Statistics for Windows version 20.0 (IBM Corp, Armonk, USA). Data are presented as mean (SD). Paired sample *t* tests or the Wilcoxon signed rank test of related samples was done as appropriate to compare continuous variables, and multiple logistic regression analysis was done to find independent factors predictive of complications after FNA. Probabilities of less than 0.05 were considered significant.

### Results

We did FNA of 7449 nodules from 6323 patients (5121 women and 1202 men), mean (range) age 54.3 (15–81) years. A single nodule was examined in 5280 patients; two in 960, and three in 83. The sizes (as evaluated by ultrasound) ranged from 6 to 100 mm (mean (SD) 18.7 (9.0) mm); 5315 were classified as large (more than 1 cm) and the remaining 2134 as small.

Ten patients had complications (0.15%) and in two they were serious. In one, a focal carotid intramural haematoma spread along the carotid wall for 7 cm during investigation of a complex thyroid nodule in a young patient (Fig. 1). Bandage pressure was immediately applied on the point of aspiration for 10 minutes. She then had antiplatelet treatment, and

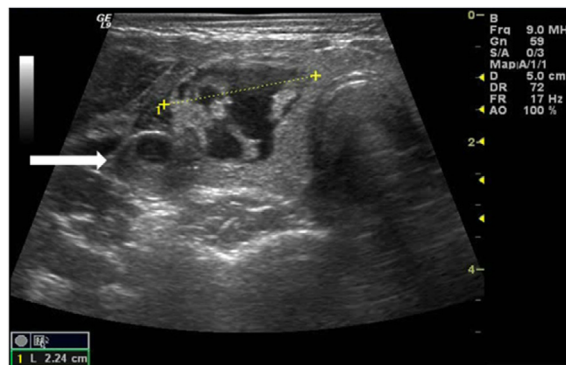


Fig. 1. Focal carotid intramural haematoma with spread along the carotid wall (white arrow) during ultrasound-guided fine-needle aspiration of a complex thyroid nodule in a young patient.

Table 1  
Patients' details and ultrasound findings.

	No complications (n = 6223)	Complications (n = 10)	p value
Mean (SD) age (years)	54.1 (16.5)	51.9 (15.7)	0.67
Sex:			0.94
Female	5112	8	
Male	1201	2	
Ultrasound findings:			
Mean (SD) size (mm)	18.9 (9.2)	19.1 (8.8)	0.95
Site:			0.88
Right	3289	5	
Isthmus	1294	2	
Left	2846	3	
Site:			0.79
Anterior	2273	4	
Posterior	4040	6	
Nodule(s):			0.15
Single	5276	5	
Multiple	2163	5	
Ultrasonographic scanner:			0.59
LOGIQ 9	4163	7	
Aplio™500	2152	3	

after three days a magnetic resonance angiogram showed that the haematoma had resolved. The other patient had cancer seeding along the track of the needle. Minor complications included intrathyroidal haematoma (n = 4), tracheal puncture (n = 2), dysphagia (n = 1), and a vasovagal reaction (n = 1).

There were no significant differences between the two groups in terms of age, sex, size of nodule, site, ultrasound features, and the scanner used (Table 1). None of the complications caused permanent problems. Multiple logistic regression of variables predicting complications (age, sex, ultrasound findings, number of nodules, and scanner) did not show any possible predictors (data not shown).

### Discussion

Over the last 30 years, the use of FNA has become widespread, and millions of procedures are now estimated

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