

# How is Contact Force implemented in routine clinical practice? Results from a French National and Monaco Survey

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## Abstract

**Background:** Combination of elementary parameters (force, time, power, impedance drop) has been proposed to optimize radiofrequency (RF) delivery. They have been partially validated in clinical studies.

**Aims:** The aim of this study was to assess contact-force (CF) implementation into clinical practice.

**Methods:** A 36-question electronic form was sent to 105 electrophysiologists (EP) including some general questions concerning the practice of catheter atrial fibrillation ablation and items concerning the parameters used for CF-guided ablation.

**Results:** Answers from 98 EP were collected (93% response rate). The CF-catheters used were Smart Touch, Biosense (52%), Tacticath, Saint-Jude Medical (12%), or both (27%) and no CF (9%). The power applied on the left atrial (LA) anterior (LAAW) and posterior (LAPW) wall was, respectively, 26–34 W (for 73% of the EP) and below 25 W (88% of the EP). Forty percent of the Visitag<sup>®</sup> users mostly used the nominal parameters. Seventy-five percent of the users did not use automatic display of the impedance drop. For the Tacticath users, 57% used a target value of 400 gs on the LAAW and 300 to 400 gs on the LAPW. Lesion Size Index was exceptionally used.

**Conclusions:** The parameters used for CF-guided ablation are widely variable among the different operators. Further prospective studies are needed to validate the targets for automatic annotation of the RF applications.

## KEYWORDS

ablation parameters, contact-force catheters, radiofrequency ablation

**Abbreviations:** AF, atrial fibrillation; CF, contact force; EP, electrophysiologists; FTI, force-time integral; LA, left atrial; LAAW, left atrial anterior wall; LAPW, left atrial posterior wall; LSI, lesion size index; PV, pulmonary vein; RF, radiofrequency.

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## 1 | BACKGROUND

Combination of elementary parameters (force, time, power, impedance drop) has been proposed to optimize radiofrequency (RF) delivery. They have been partially validated in clinical studies.

Different catheters and technologies are available for arrhythmias ablation: RF with or without contact-force (CF)-sensing catheters, remote magnetic navigation,<sup>1</sup> or even cryotherapy.<sup>2</sup>

CF catheters have been available since less than 10 years and have been shown to reduce the complications.<sup>3,4</sup> A recent study reported a high 1-year clinical success for paroxysmal atrial fibrillation (AF) ablation using the Ablation Index algorithm as well as the creation of contiguous lesions.<sup>5</sup> Nevertheless, until now, there is not yet any recommended consensus for the targets values (power, impedance drop) in the guidelines for AF ablation (class IIA recommendation to target a minimal CF of 5-10 grams).<sup>6</sup>

We hypothesized that high variations may be seen with the use of CF parameters among the operators as well as the different cut-offs for power applied, according to the different anatomical locations. Our goal was to analyze CF implementation in routine clinical practice in a binational survey.

## 2 | METHODS

Over a 2-month period (June-July 2016), a 36-question electronic form (Google form) was sent to 105 electrophysiologists (EP) from two countries (France, Monaco), including some general questions concerning the practice of catheter AF ablation and items concerning the parameters used for CF-guided ablation (Supplementary Materials: Table S1).

### 2.1 | Statistical analysis

The statistical analysis was made with Excel (San Diego, CA, USA). Categorical variables are described as number (percentage). Continuous variables are described as mean  $\pm$  SD for variables with normal distributions or as median for variables not normally distributed.

## 3 | RESULTS

### 3.1 | Characteristics of the operators/centers

Answers from 98 EP were collected (93% response rate). The operators practiced arrhythmias ablation since more than 10 years (42/98, 42.9%), 5-10 years (32/98, 32.7%), 1-5 years (23/98, 23.5%), and less than 1 year (1/98, 1%). Their center of practice was university hospital (46/98, 46.9%), non-university hospital (16/98, 16.3%), and private institution (34/98, 34.7%).

In the different centers, the mean annual number of ablations was above 300 (64/98, 65.3%), between 200-300 (24/98, 24.5%), between 100-200 (5/98, 5.1%), and below 100 (5/98, 5.1%).

### 3.2 | AF ablation

The cryoablation was usually performed in the center predominantly (11/98, 11.2%), similar to RF (18/98, 18.4%), less than RF (27/98, 27.6%), not performed (42/98, 42.9%). Considering the use of general anesthesia, EP answered: almost always used (55/98, 56.1%), three quarters of the procedures (4/98, 4.1%), half of the procedures (4/98, 4.1%), less than one quarter of the procedures (4/98, 4.1%), exceptionally (29/98, 29.6%).

An esophageal probe for esophageal temperature monitoring was used by 42/98 EP (42.9%), not used by 54/98 (55.1%), and not standardized by 2/98 (2%).

### 3.3 | CF-sensing catheters

The CF-catheters used were Smart Touch, Biosense (51/98, 52%), TactiCath, Saint-Jude Medical (12/98, 12.2%), both (27/98, 27.6%), conventional without CF (7/98, 7.1%), and magnetic catheter (1/98, 1%). CF-sensing catheters were used for atrial arrhythmias ablations only (18/98, 18.4%), both atrial and ventricular arrhythmias ablations (74/98, 75.5%), and not used (6/98, 6.1%).

A steerable sheath was used for LA ablations only by 7/98 operators (7.1%), in comparison with a standard sheath with a fixed curve for 86/98 EP (87.8%).

Considering particularly AF/left atrial (LA) ablations, CF-catheters are used by 90/98 EP (91.8%) and not used by 8/98 (8.2%).

The power applied on the left atrial (LA) anterior (LAAW) and posterior (LAPW) wall was, respectively, 26-34 W (for 73.5% of the EP, 72/98) and below 25 W (86/98, 87.8% of the EP). 43.8% of the Visitag<sup>®</sup> users (43/98) are mostly using the nominal parameters (Figure 1). Seventy-five percent of the users (74/98) did not use (not concerned for 25 and using nominal parameters for 49) automatic display of the impedance drop (Figure 2). For the TactiCath users (47 EP), 57% (27/47) used a target value of 400 gs on the LAAW and 30% (14/46) of them applied 300-400 gs on the LAPW (Figure 3). Lesion Size Index (LSI) was exceptionally used.

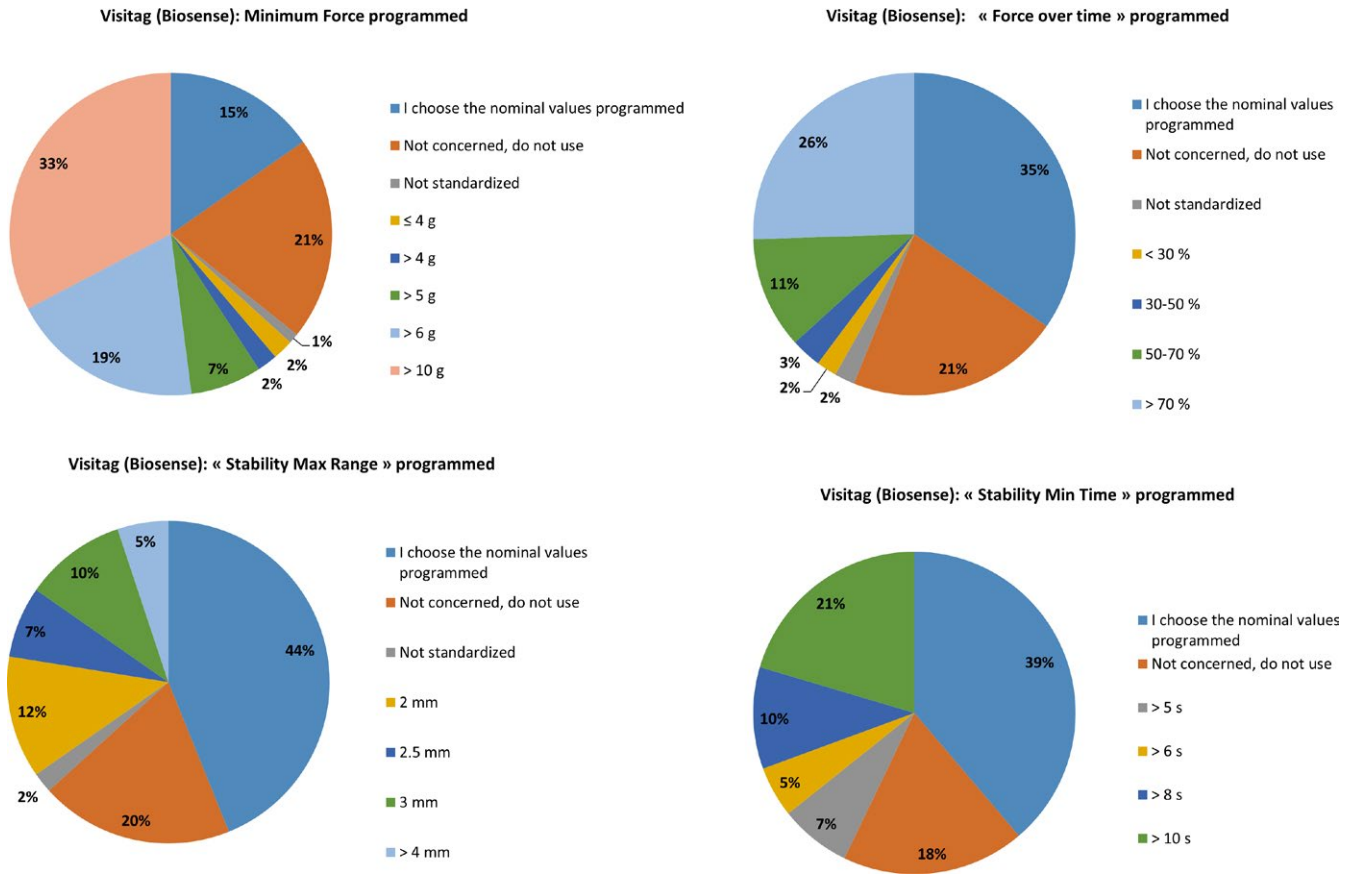
Visual gaps (even in the absence of local residual electrogram signal) inside an ablation line are targeted by 50/98 (51% of the EP); they are not ablated (37/98, 37.8%); the attitude is non-standardized (11/98, 11.2%).

Finally, 77/98 (78.6%) EP replied that they systematically use CF catheters. The main reasons for not using CF-catheters were 21/98 answers: other reason (13/21, 62%), their cost (7/21, 33.3%), and (1/21) 4.5% were not concerned (RF not used).

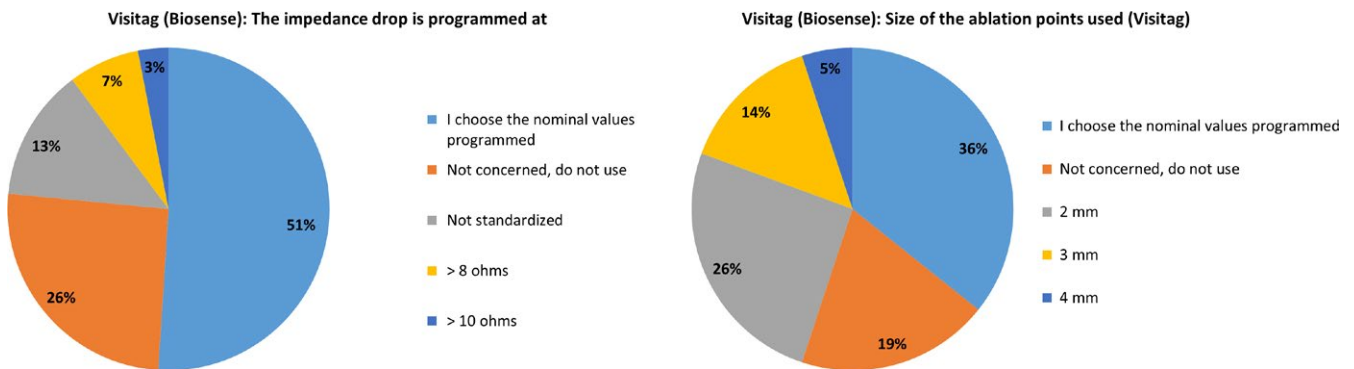
## 4 | DISCUSSION

Our study shows that, even if available, CF-guided ablation is still not a standard of care. When used, there is a huge heterogeneity of the parameters chosen during ablation among the different centers.

To the best of our knowledge, this is the first survey evaluating the use of CF-catheters in routine clinical practice.



**FIGURE 1** Different parameters used by the electrophysiologists for the automatic annotations of the ablation lesions (Visitag®)



**FIGURE 2** Parameters used by the electrophysiologists considering the impedance drop and diameter of the ablation points (Visitag®)

The lack of standardization of all RF parameters (power, force target, but also application time, minimum catheter stability criteria, maximal interlesion distance) could be one of the reasons why PV isolation is still associated with moderate clinical success at 1 year (65% in the Fire and Ice study), even two decades after initiation of paroxysmal AF ablation.<sup>2</sup>

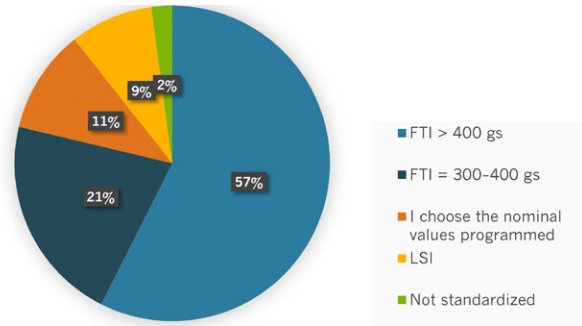
Some specific observations may be emphasized from the results of our survey. Interestingly, a majority of the operators did not use the impedance drop as a criterion during RF ablation (74/98, 75% of the operators). One has to notice that the impedance drop has not been mentioned as an indicator during ablation,

in the last international guidelines for RF catheter AF ablation.<sup>6</sup> In this recent consensus, a minimum of 5-10 g target when applying RF energy was the only indication, without any precisions concerning the FTI.

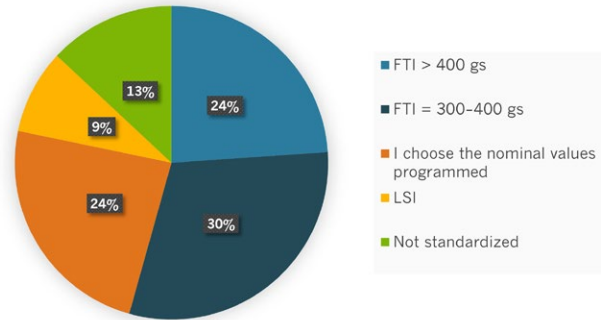
CF-sensing technology is still not a standard of care, but is being commonly used in most centers from France and Monaco (90/98, 91.8% for LA ablation procedures in our survey). The diffusion of the CF-technology has been fast because no data concerning its use were reported from the last European survey published in 2015.<sup>7</sup>

Some studies have validated a target value of 400 gs for FTI, which may explain that a majority of the operators in this study

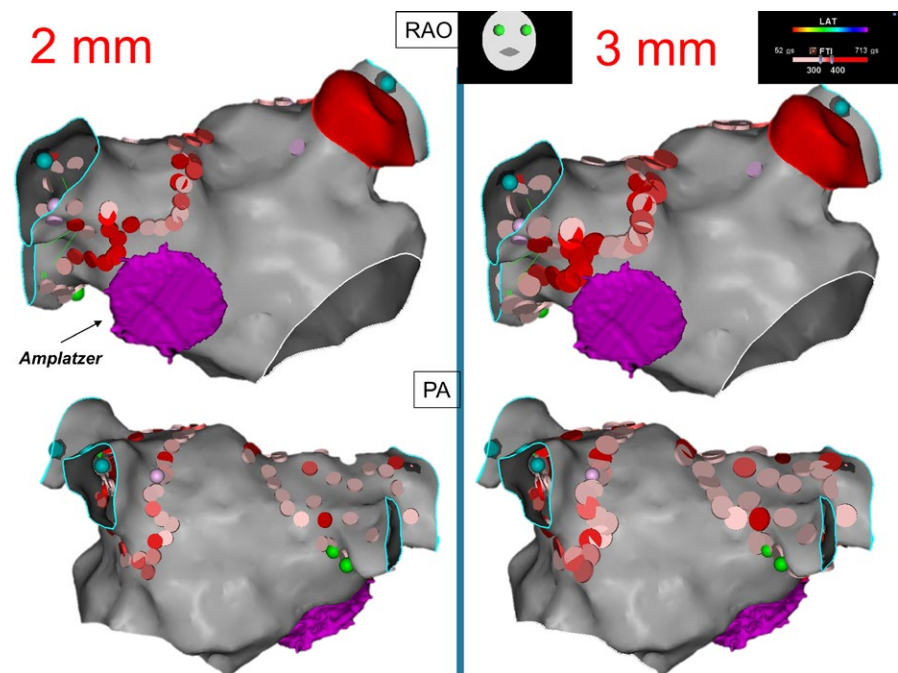
**Tacticath (Saint-Jude) :  
criteria for left atrial  
anterior wall**



**Tacticath (Saint-Jude) :  
criteria for left atrial  
posterior wall**



**FIGURE 3** Parameters used by the electrophysiologists considering the force-time integral (Tacticath®, Saint-Jude Medical)



**FIGURE 4** Left atrial electroanatomical maps in right anterior oblique (upper images) and anteroposterior projection, when applying a variation in the diameter (2 mm on the left images and 3 mm for the right images) of the ablation points (Visitag®), in the same patient

chose this value as a cutoff value.<sup>8</sup> Considering the power, the majority of the operators (86/98, 87.8%) apply less than 25 W on the LAPW and between 26 and 34 W on the LAAW (72/98, 73.5% of the users). This is a class I indication in the last guidelines to decrease the power on the LAPW, but no indicative value was cited in the recommendations (only 1/98, 1% of the operators apply more than 35 W on the LAPW in our study). It is to note that this LSI was exceptionally used in our survey.

The use of automatic annotation algorithms has shown to be significantly superior to manual annotation for AF ablation procedures.<sup>9</sup> Nevertheless, the Visitag® software is a multiparametric

algorithm, and our survey demonstrates a high variability in the parameters used in routine clinical practice. When applying a variation in the diameter of the ablation tags for instance, a high variability in the interlesion distance may be observed (Figure 4). No definite and precise parameters have been validated in clinical trials, until the recent validation of the ablation index algorithm.<sup>10,11</sup>

Some authors have reported that strict catheter stability criteria using the Visitag® module (a 3-mm distance limit for at least 10 s and a minimum CF of 10 g over 50% of the set time period with a target FTI  $\geq$ 400 gs) were associated with less dormant conduction in comparison with moderate criteria (3-mm distance limit for at least

5 s and a minimum CF of 8 g over 25 % of the set time period with a target FTI  $\geq 300$  gs).<sup>12</sup>

Using the Ablation Index, El Haddad M et al, from the Bruges group, compared the data from an historical group using CF with a group using an ablation index-guided ablation.<sup>11</sup> They found that an interlesion distance above 5 mm (between ablation tags) was a predictor of PV reconnection. Surprisingly, in our survey, only 51% of the EP admitted to systematically target the visual gaps in the ablation line.

Taghji P et al from the same group recently reported the results of PV isolation using an ablation index above 550 on the LAAW and 400 on the LAPW, with a high clinical success (91.3% anti-arrhythmic drugs off) at 1 year after a single procedure.<sup>5</sup> Another study just reported promising results with a good safety profile, in a mixed population of paroxysmal/persistent AF patients, but using lower ablation index values.<sup>13</sup> These data are to be confirmed in a multicenter study (ongoing trial). If adopted, this strategy is likely to expand and should decrease the heterogeneity of the different practices among operators for paroxysmal AF ablation.

## 5 | LIMITATIONS

Operators who are not using the CF technology may have felt less interested in answering the survey, but the response rate was significantly high (93%). This may represent a bias, but the survey itself was not only considering CF-guided ablation, because some general questions were also asked about the practice of AF ablation: regimen of anticoagulation, the use of a urinary catheter...

## 6 | CONCLUSIONS

The parameters used for CF-guided ablation are widely variable among the different operators. Further prospective studies are needed to validate the targets for automatic annotation of the RF applications.

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## CONFLICTS OF INTEREST

The authors declare no conflict of interests for this article.

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#### SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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