ROLE OF THE CARDIAC SYNCHRONISED COMPUTED TOMOGRAPHY ANGIOGRAPHY IN DIAGNOSIS AND FOLLOW UP OF THE DISSECTION OF DESCENDING THORACIC AORTA

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BACKGROUND
Computed tomography angiography (CTA) is crucial for the diagnosis of descending thoracic aortic (DTA) dissection, especially in emergency setting due to its accuracy and ready availability. An appropriate and accurate imaging protocol permits not only to perform the diagnosis but to improve the clinical outcomes in these cases. CTA in aortic dissection allows the monitoring of changes in aortic diameters, in the relationship between the two lumen (and their specification), any visceral vessels occlusion (i.e. intercostal, mediulary arteries) caused by the hematoma inside the wall or by oscillation of the dissection flap. However, some of these elements are influenced by blood flow, and therefore they can change during the cardiac cycle.

Differently from conventional CTA without ECG-gated which only can capture the static images of the intimal flap and reflect the conformation of the intimal flap at an arbitrary time point, retrospective ECG-gated CTA (CCTA) allows the phase cine imaging and visualization of the intimal flap along all the cardiac cycle. Current literature reports cardio-synchronization in the aorta CT scan is usually proposed only in the study of the ascending tract.

Our aim is to to understand if the changes in the relationship between the false and the true lumen in the dissection of descending thoracic aorta observed with CCTA are statistically significant and therefore identify a possible role for CCTA in the DTA.

PATIENTS AND METHOD
23 patients with DTA dissection (16 female, 7 male, average age 67 yo) were retrospectively analyzed. 4 CTAs were performed in emergency conditions in suspected acute aortic syndrome, 19 were routine follow up of residual chronic DTA dissection after ascending aorta open surgery. The CCTA protocol included a ECG-gated protocol with dose modulation. Each data set was reconstructed in 5% steps between 40% to 80% of R-R cardiac cycle intervals. In each examination 3 areas were evaluated (true lumen area, TLA, false lumen area, FLA, total area, ToTA) at two different level (2 cm below the isthmus and 3 cm above the diaphragm), in three different phases (2 arterial phases, 40%, the closest one to the systole without many motion artifacts, and 75%, the telediastolic phase) of R-R cardiac cycle, and the venous phase, used as the non-cardiac-synchronized phase).

RESULTS
The TLA was statistically larger (paired t-test, p<0.005) in the arterial phase at 40% than the one at 75% at both sites (proximal and distal) (Fig. 1). The data were inverted for the FLA: it was smaller in the arterial phase at 40% than at 75% (paired test, p=0.005) at both sites (Fig. 2). There were no statistically significant changes in ToTA in any phase or site (paired t-test, <0.005). No statistically significant differences were observed in the venous phase (paired t-test, p=0.005) between TLA, FLA and ToTA at either site (Fig. 3).

DISCUSSION
Heart activity influences the “behaviour” of the dissection of the descending thoracic tract and important elements change in a statistically significant way during systol and diastol phases: true and false lumen areas, their relationship and intimal flap. Conventional CTA without ECG-gated only can show static images of the intimal flap and reflects the conformation of the intimal flap only at an arbitrary time point, as confirmed in our study. In our study the non-ECG-gated phase) there were no statistically sifferences between TLA, FLA and ToTA in either site. Therefore, in a no-gated acquisition, the TLA and FLA have random intermediate values, between the arterial 40% and 75% phases. This lead to the evidence that for an adequate diagnosis and follow up of dissection of DTA, non-ECG gated CTA has several limits when compared to CCTA

CONCLUSIONS
In DTA dissections, CCTA represents a reliable imaging technique to accurately diagnose and compare patients examination during the follow up.

In presence of symptoms, CTA can help to promptly identify patients who could require treatment because of transient blood flow reduction due to intimal flap movements during the cardiac circle.

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FIG. 1: The graphics show TLA changes in the arterial phases at the two different sites

FIG. 2: The graphics show the FLA changes in the arterial phases at the two different sites

FIG. 3: The graphics show the FLA and TLA changes in the venous (non-gated) phase