



Non Invasive Imaging (Echocardiography, Nuclear, PET, MR and CT)

DIAGNOSIS AND DIFFERENTIATION OF ACUTE MASSIVE AND SUBMASSIVE FROM SUBSEGMENTAL PULMONARY EMBOLISM USING NOVEL ECHOCARDIOGRAPHIC METHODS

Poster Contributions
Poster Hall, Hall A/B
Sunday, March 11, 2018, 9:45 a.m.-10:30 a.m.

Session Title: Echocardiography For Assessing the Various Chambers: Right Ventricle, Atria, Sorta and Pericardium
Abstract Category: 28. Non Invasive Imaging: Echo
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Background: Explore the utility of echocardiography in identifying acute pulmonary embolism (APE) subtypes

Methods: Using data on patients with CT-confirmed diagnosis of massive/submassive APE (M/S APE), subsegmental APE (SSAPE), and normal controls, we evaluated the utility of the novel early systolic notching (i.e. "spike and dome" RVOT Doppler pattern) for diagnosing M/SAPE, using probability statistics and ROC analysis. We also evaluated the incremental value of combining other echo parameters to our novel method.

Results: 300 subjects; 100 each of M/S APE, SSAPE and controls were analyzed. Mean (SD) age was 56 (16) and 48% of subject were male. Identification of a spike and dome pattern on echo demonstrated good to excellent predictive ability for M/S APE with sensitivity 90% (95% CI: 82-96%), specificity 95% (92-97%), PPV 93% (90-95%), NPV 93% (90-95%), and area under the receiver operating characteristics curve [AUROC] of 0.92 (0.90-0.95) (Table 1). The spike and dome pattern in combination with specific RVOT Doppler parameters i.e. acceleration time ≤ 87 ms, acceleration slope ≥ 810 cm/s², and deceleration slope ≤ 232 cm/s² showed incremental benefit. In secondary analysis, the spike and dome pattern performed poorly for SSAPE

Conclusion: Early systolic notching, with incremental benefit of Doppler variables emerged as the most sensitive and specific predictors of M/S APE. Echocardiography also effectively distinguished M/S APE from SSAPE that tend to be linked with a much lower mortality risk

Table 1: Echocardiographic parameters and probability statistics of full APE cohort.

	No PE (n=100)	Subsegmental PE (n=100)	Massive/submassive PE (n=100)	P value		Sensitivity	Specificity	Positive predictive value	Negative predictive value	AUROC
McConnell sign, %	0	7.1	51	<0.001	McConnell sign	51% (39-63%)	69% (43-97%)	68% (20-96%)	73% (64-80%)	0.70 (0.44-0.87)
Spike and dome, %	0	2.0	91	<0.001	Spike and dome	90% (82-96%)	95% (92-97%)	93% (90-95%)	93% (90-95%)	0.92 (0.90-0.95)
Acceleration time, mean (SD), ms	146 (45)	98 (37)	61 (19)	<0.001	Acceleration time ≤ 87 ms	89% (83-94%)	72% (67-79%)	60 (52-69%)	91 (88-94%)	0.80 (0.75-0.84)
Deceleration time, mean (SD), ms	186 (46)	175 (57)	219 (44)	<0.001	Deceleration time ≥ 200 ms	64% (53-73%)	70% (63-76%)	49% (39-58%)	81% (74-87%)	0.67 (0.61-0.73)
DA ratio, mean (SD)	1.4 (0.61)	2.1 (1.2)	3.9 (1.5)	<0.001	DA ratio ≥ 2.36	83% (74-90%)	79% (71-83%)	67% (57-75%)	90% (85-93%)	0.80 (0.76-0.85)
Acceleration slope, mean (SD), cm/s ²	567 (254)	949 (514)	1317 (545)	<0.001	Acceleration slope ≥ 810 cm/s ²	85% (78-91%)	66% (60-73%)	53% (46-63%)	91% (87-96%)	0.76 (0.73-0.81)
Deceleration slope, mean (SD), cm/s ²	311 (134)	348 (142)	218 (86)	<0.001	Deceleration slope ≤ 232 cm/s ²	66% (55-76%)	74% (67-79%)	53% (43-62%)	83% (76-88%)	0.70 (0.64-0.75)
RV dilation >4.1 , %	23	50	66	<0.001	RV dilation >4.1	65% (53-76%)	65% (57-72%)	43% (34-53%)	82% (74-88%)	0.65 (0.58-0.71)
Slope ratio, mean (SD)	2.0 (1.0)	3.0 (2.1)	6.5 (2.5)	<0.001	Slope ratio ≥ 4	81% (72-89%)	83% (79-88%)	73% (63-81%)	90% (85-93%)	0.83 (0.80-0.86)

Glossary:
"Spike and Dome": Morphological pattern of early systolic notching of RVOT Doppler (see image on right)
Acceleration time: RVOT Doppler time measured from onset of systole to peak velocity of systole
Deceleration time: RVOT Doppler time measured from peak systolic velocity to end of systole
DA ratio: Deceleration time/Acceleration time
Acceleration slope: RVOT Doppler slope measured from onset of systole to peak velocity
Deceleration slope: RVOT Doppler slope measured from peak velocity to end of systole
Slope Ratio: Acceleration Slope/Deceleration Slope

