LAA Closure: Step-by-Step from Septal Puncture to Device Detachment

AP Valves 2019 LAA Closure: A-to-Z with Experts

10/8/2019 9:10am to 9:30am

Simon Lam

MBBS(HK) FRCP (Glas) FHKCP (HK) FHKAM (HK) FACC

Associate Consultant

Structural Heart Intervention Program

Division of Cardiology, Department of Medicine,

Queen Mary Hospital, Hong Kong

Disclosures

- Proctor
  - St Jude Medical/Abbott
  - Edwards LifeScience
  - Lifetech Scientific
  - Boston/Claret Medical

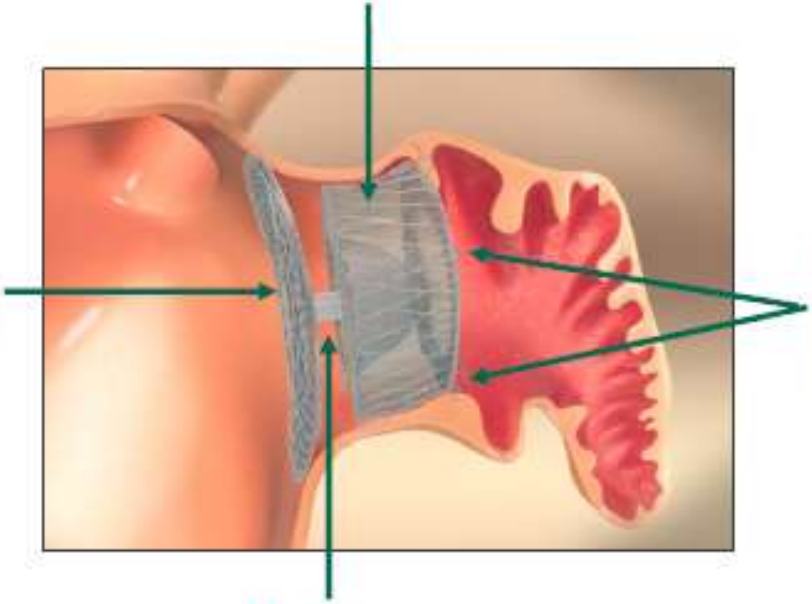
AMULET

A1

SJM AMULET LAA Occluder

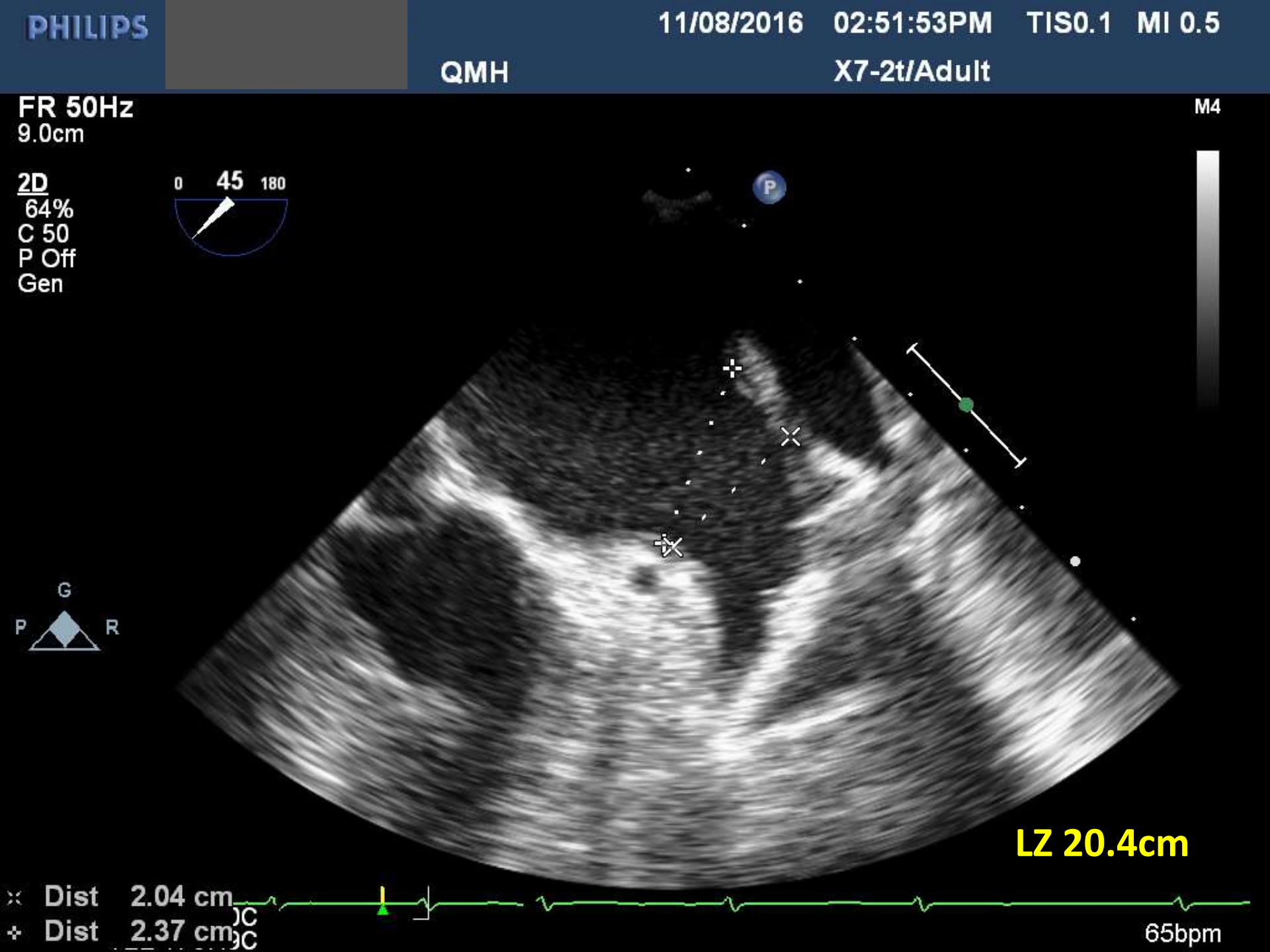
Lobe
- Positioned inside the LAA neck
- Designed to conform to different sizes and shapes of LAA anatomy

Disc
- Designed to completely seal the LAA at the orifice



Stabilizing Wires
- Engage with the wall of the LAA
- Help hold the device in place

Waist
- Maintains tension between lobe and disc
- Flexible connection allows device to self-orient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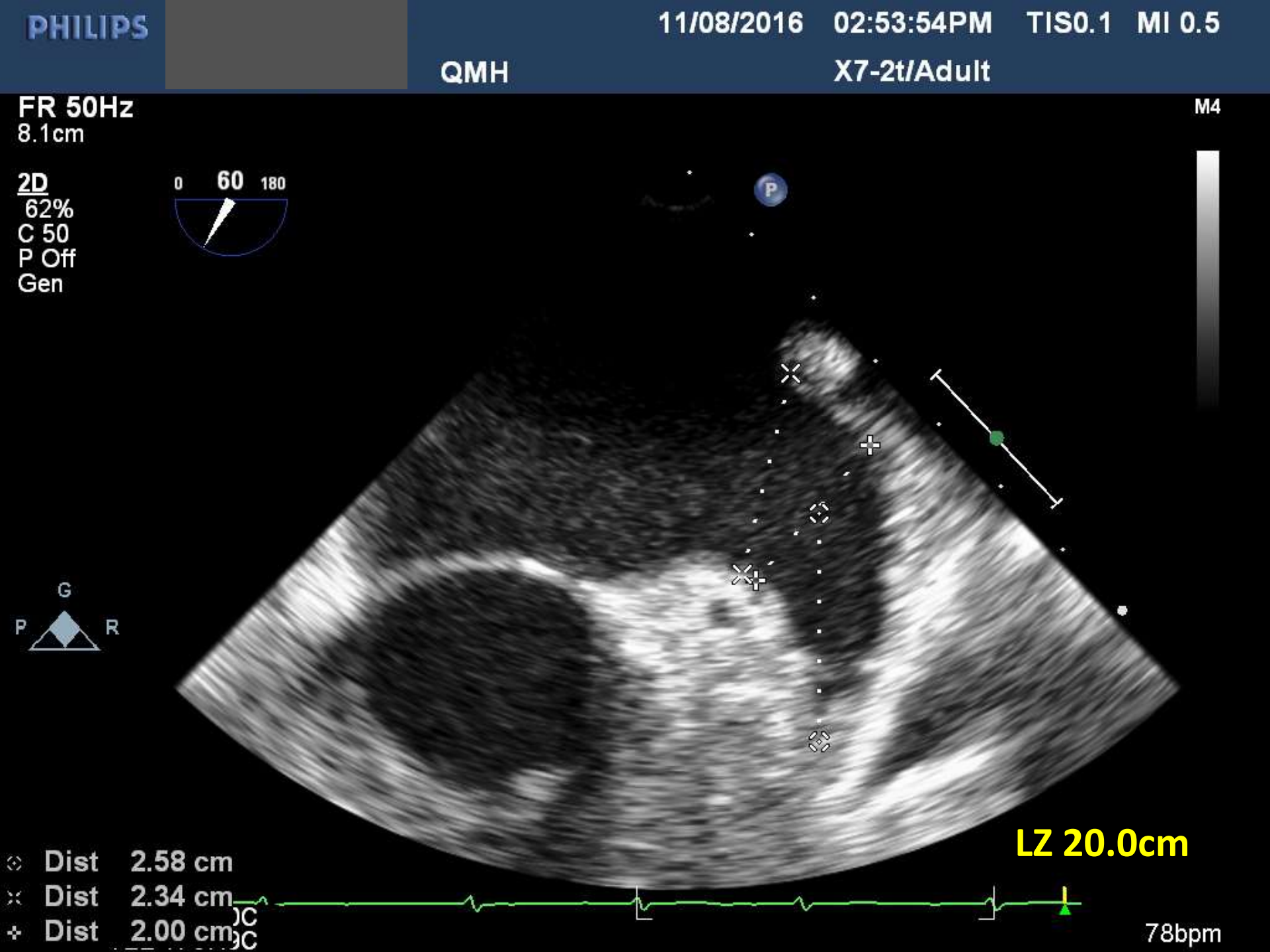
QMH
X7-2t/Adult
FR 50Hz
9.0cm
M4
2D
64%
C 50
P Off
Gen
0 45 180
G
P R
LZ 20.4cm
Dist 2.04 cm
Dist 2.37 cm
65bpm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8.1cm
M4
2D
62%
C 50
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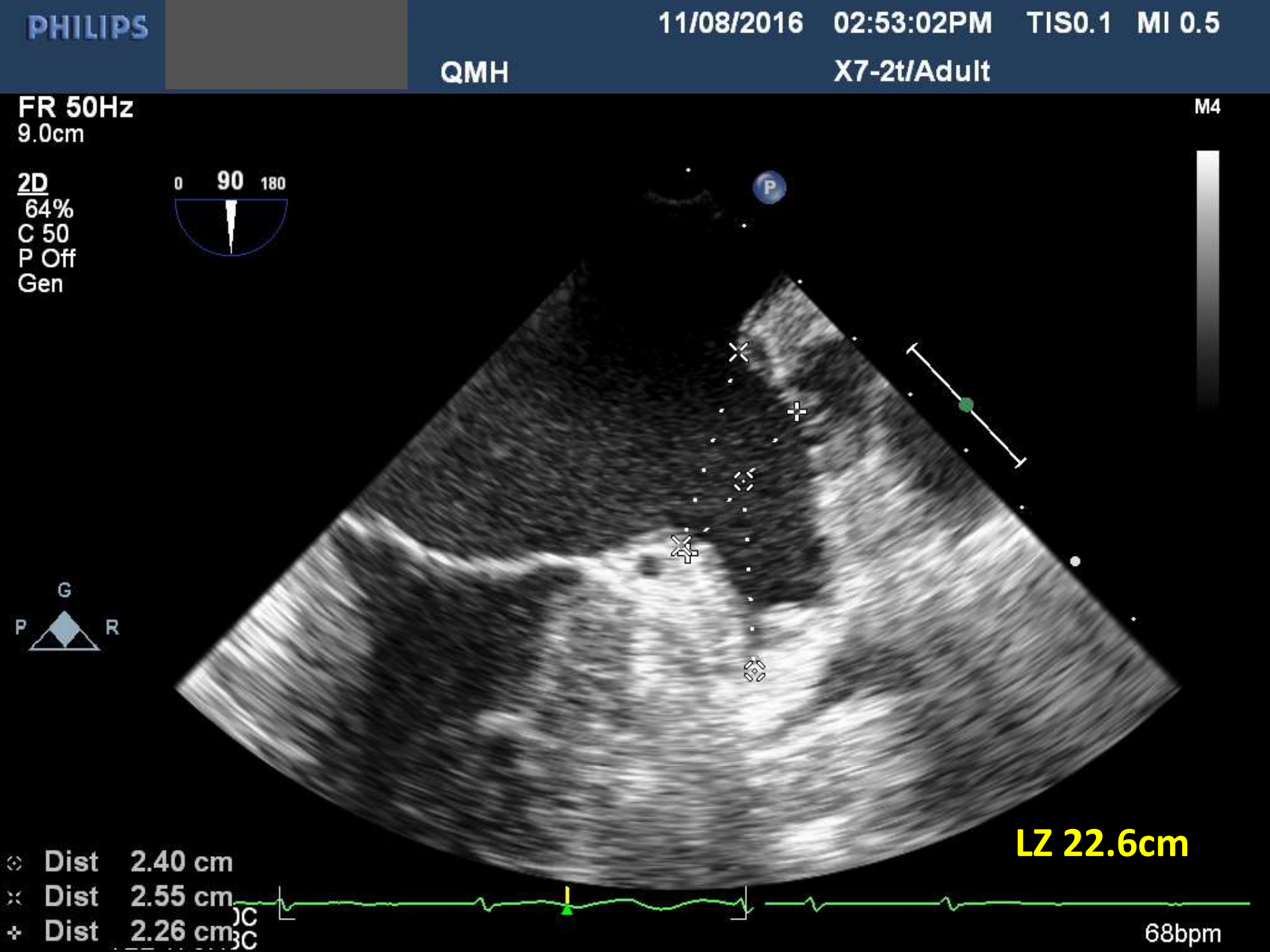
Gen
0 60 180
G
P R
LZ 20.0cm
Dist 2.58 cm
Dist 2.34 cm
Dist 2.00 cm
78bpm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M4
2D
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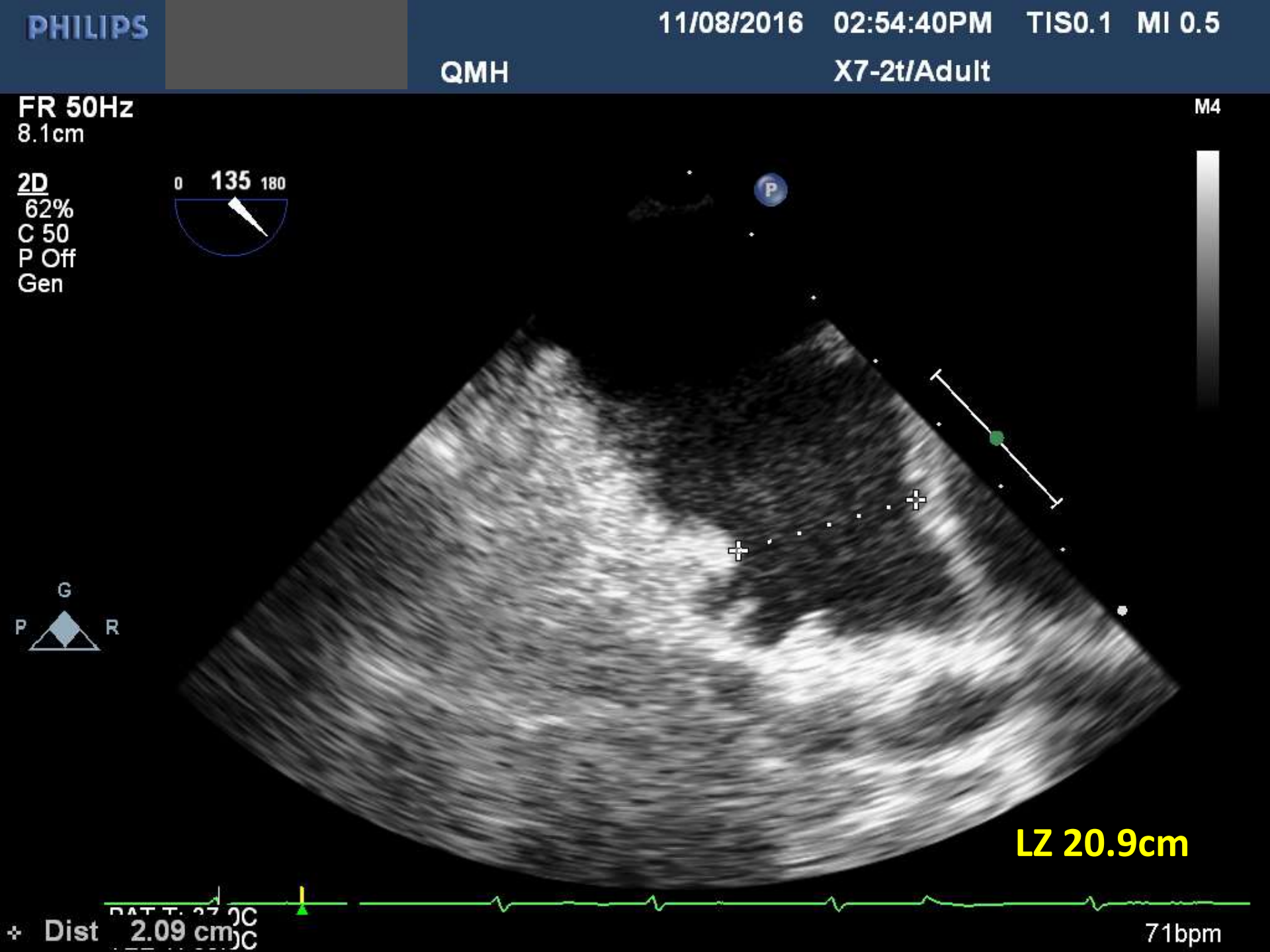
Gen
0 90 180
G
P R
LZ 22.6cm
Dist 2.40 cm
Dist 2.55 cm
Dist 2.26 cm
68bpm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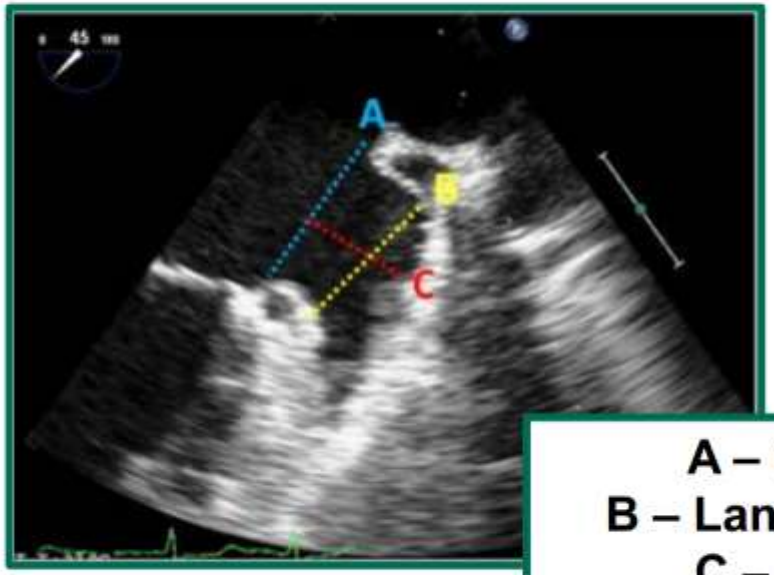
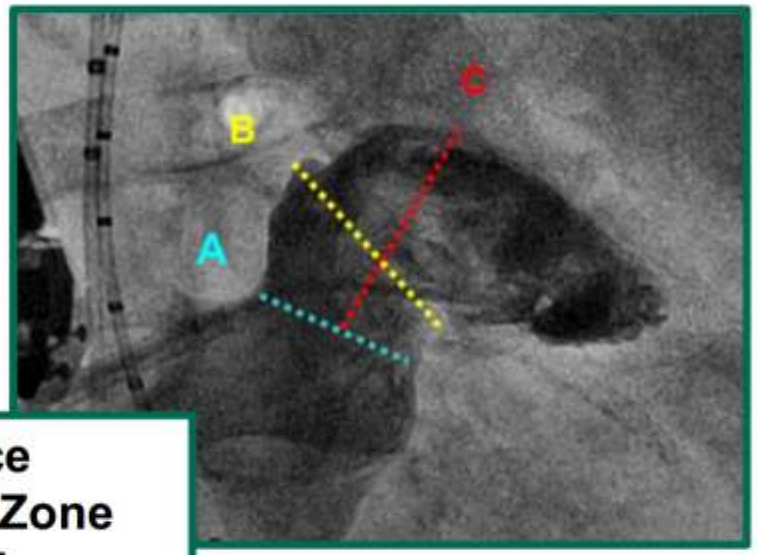
8.1cm
M4
2D
62%
C 50
P Off
Gen
0 135 180
G
P
R
LZ 20.9cm
Dist 2.09 cm
71bpm

Measurements and Sizing

- Measurements should be taken using both echocardiography and angiography
- A marker pigtail can be used for LAA access and calibration
- RAO 30° Cranial 10-20° is the most common angiographic projection
  - A range of views in TOE and angiography can help identify the best view for device deployment

My personal preference - RAO 30 CRAU 20

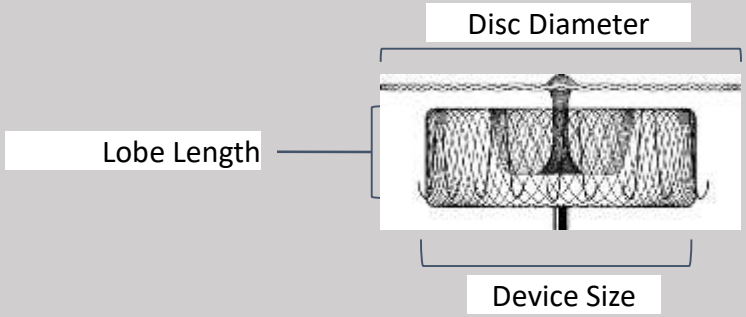




A – Orifice
B – Landing Zone
C – Depth

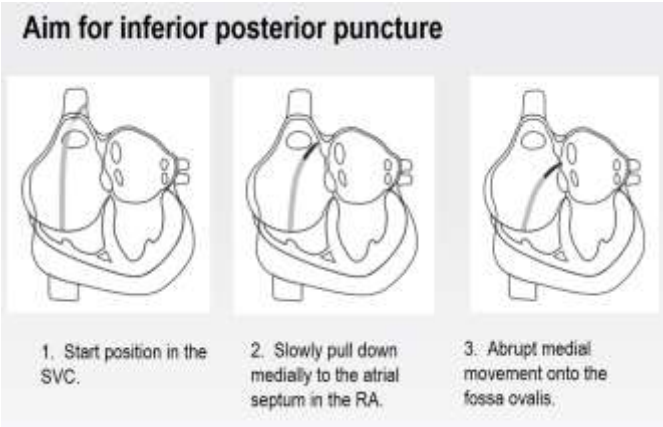
Device Size Selection - Amulet

Maximum Landing Zone Width (mm)	Amulet™Device Size	Lobe Length (mm)	Minimum LAA Depth (mm)	Disc Diameter (mm)	Sheath Diameter
11.0-13.0	**16**	7.5	≥ 10	22	12 F *or* 14 F (with adaptor)
13.0-15.0	**18**	7.5	≥ 10	24	
15.0-17.0	**20**	7.5	≥ 10	26	
17.0-19.0	**22**	7.5	≥ 10	28	
19.0-22.0	**25**	10	≥ 12	32	
22.0-25.0	**28**	10	≥ 12	35	14 F
25.0-28.0	**31**	10	≥ 12	38	
28.0-31.0	**34**	10	≥ 12	41	



Transseptal Access

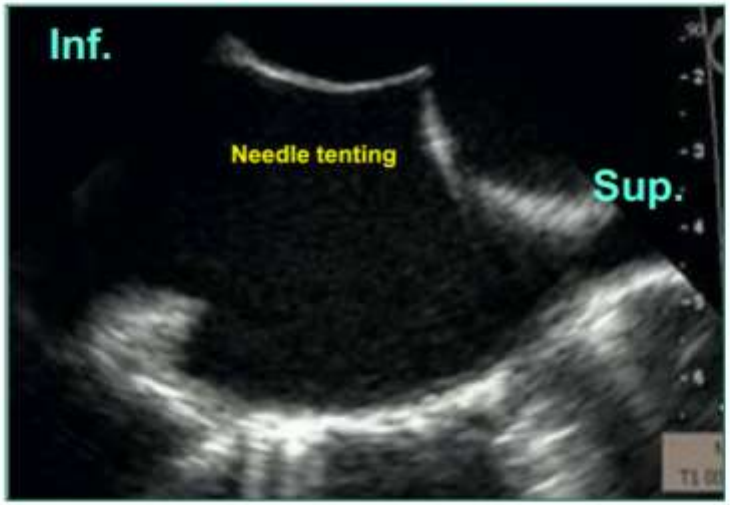
- An inferior and posterior puncture is ideal.
  - Guided by echocardiography
  - Achieves appropriate sheath alignment in LAA



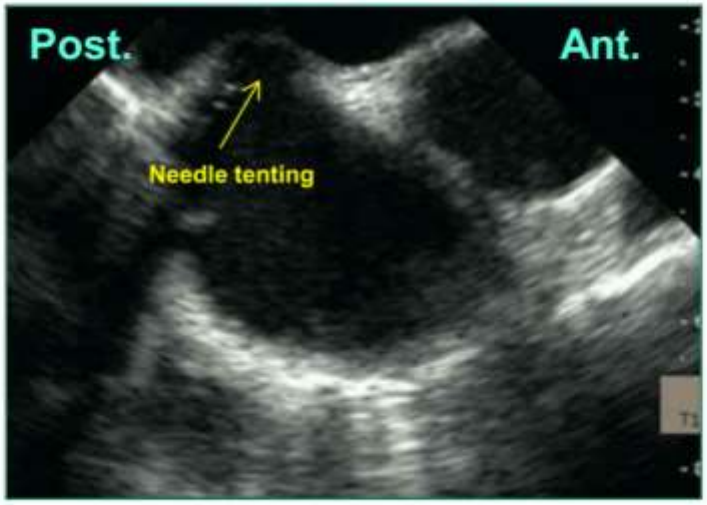
- Access via existing PFO may not provide good alignment with the left atrial appendage.

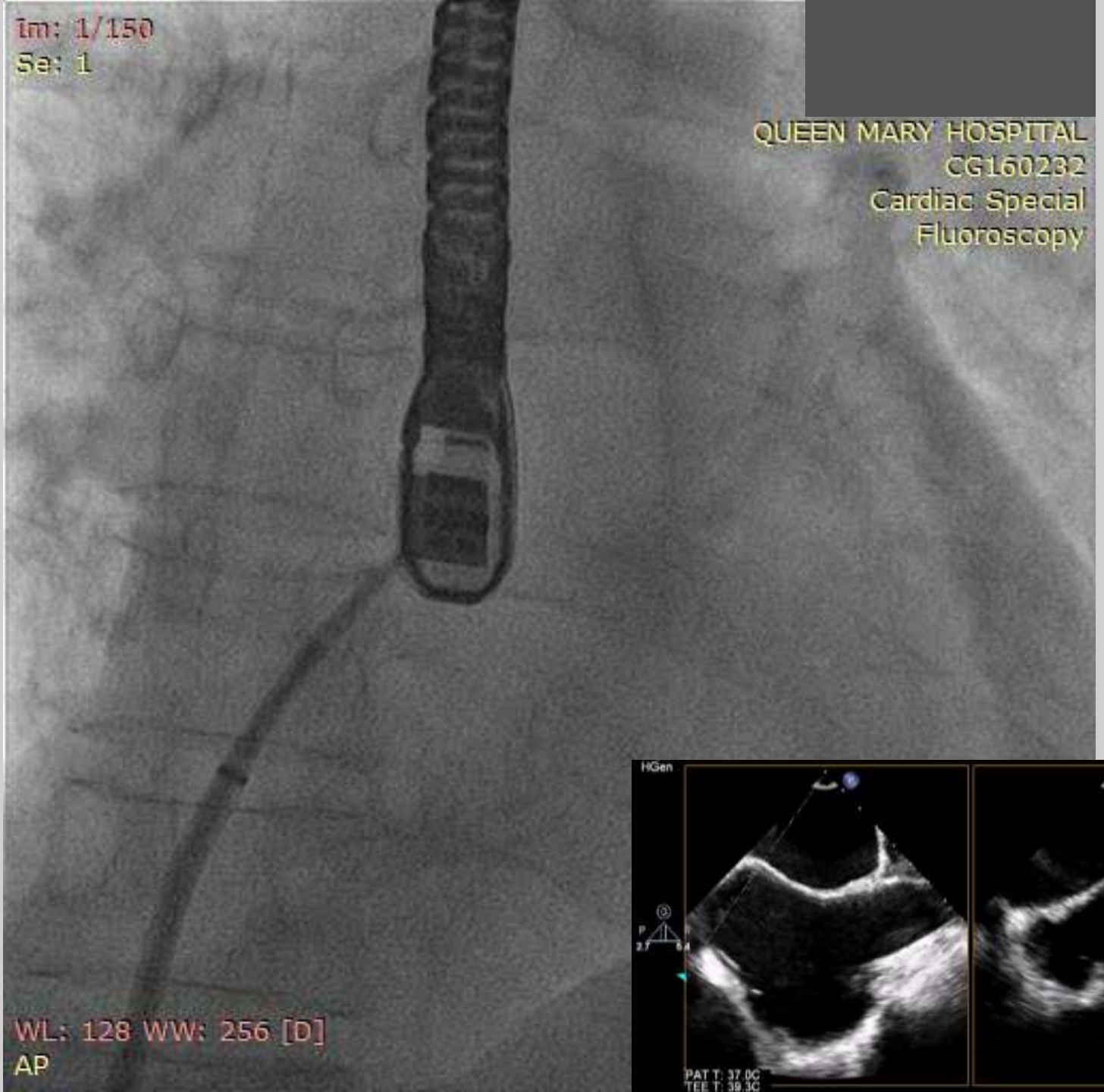
- After transseptal puncture maintain an ACT of at least 250 seconds.

Bi-Caval View (TEE)



Short Axis View (TEE)

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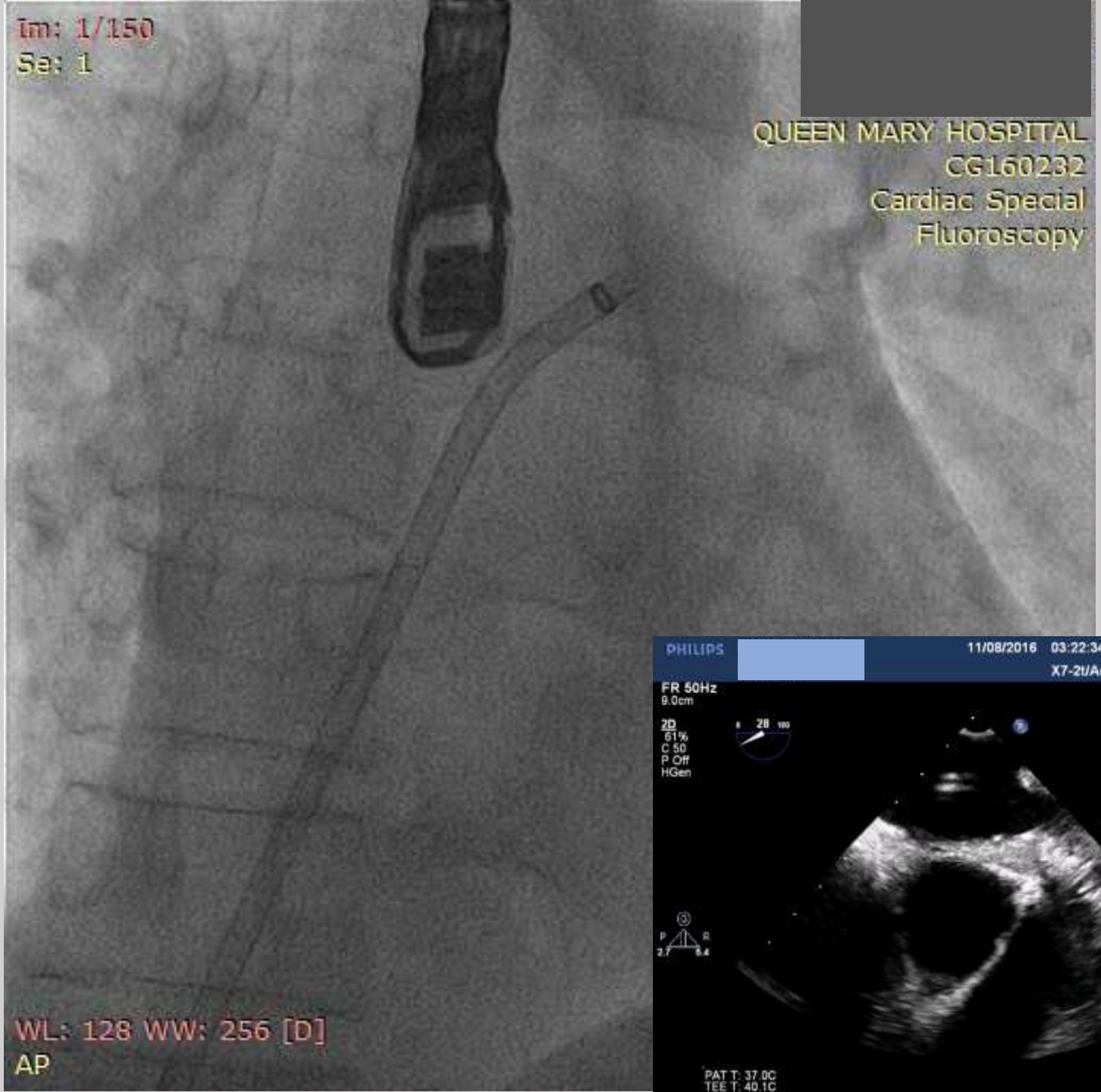
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
AP
HGen
75 bpm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CG160232
Cardiac Special
Fluoroscopy
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AP
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X7-2t/Adult
FR 50Hz
9.0cm
2D
61%
C 50
P Off
HGen
JPEG
PAT T: 37.0C
TEE T: 40.1C
61 bpm


Im: 1/107
Se: 1
QUEEN MARY HOSPITAL
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CRA: 20
PHILIPS
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X7-2t/Adult
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HGen
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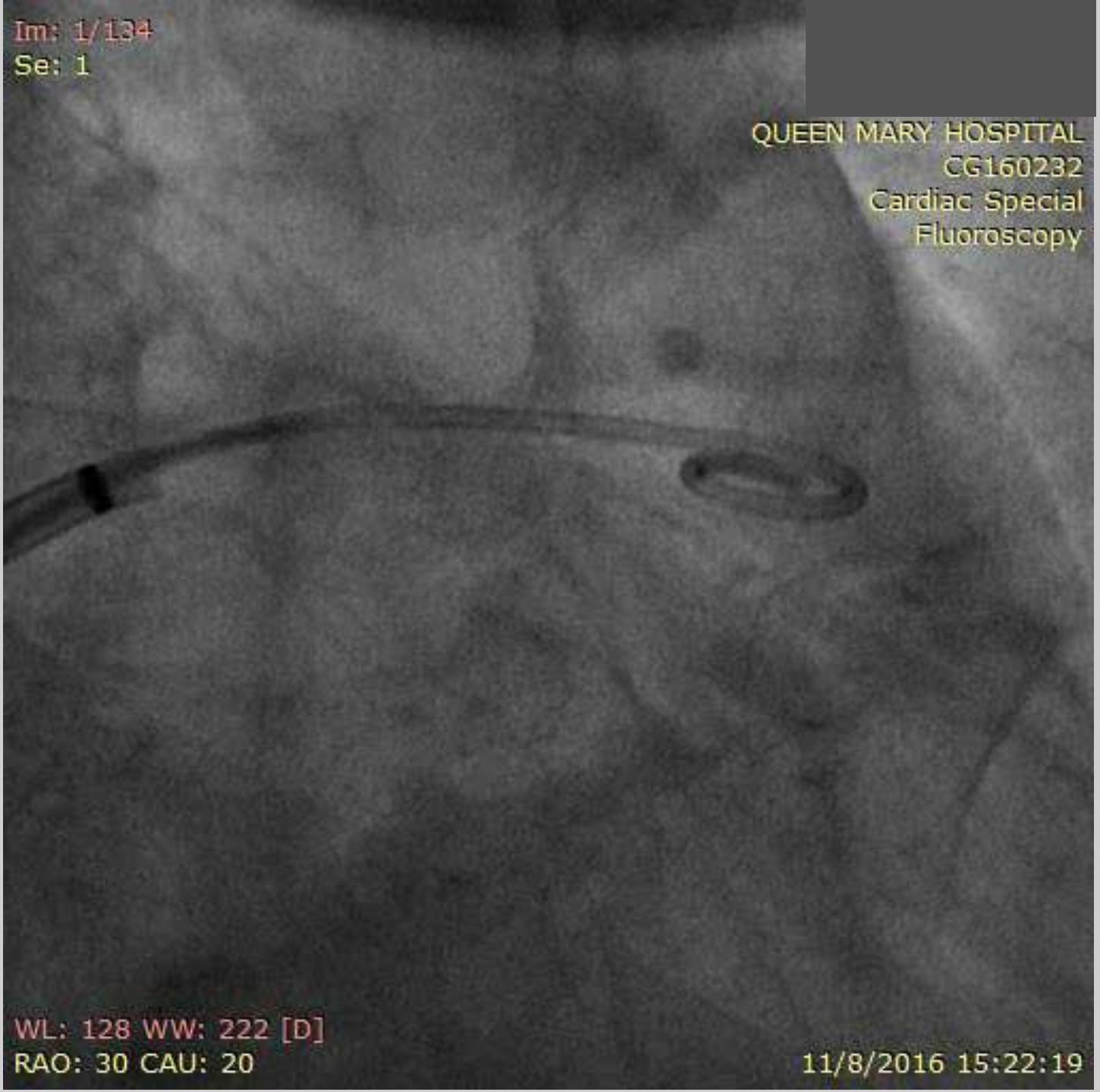
TEE T: 39.7C
54 bpm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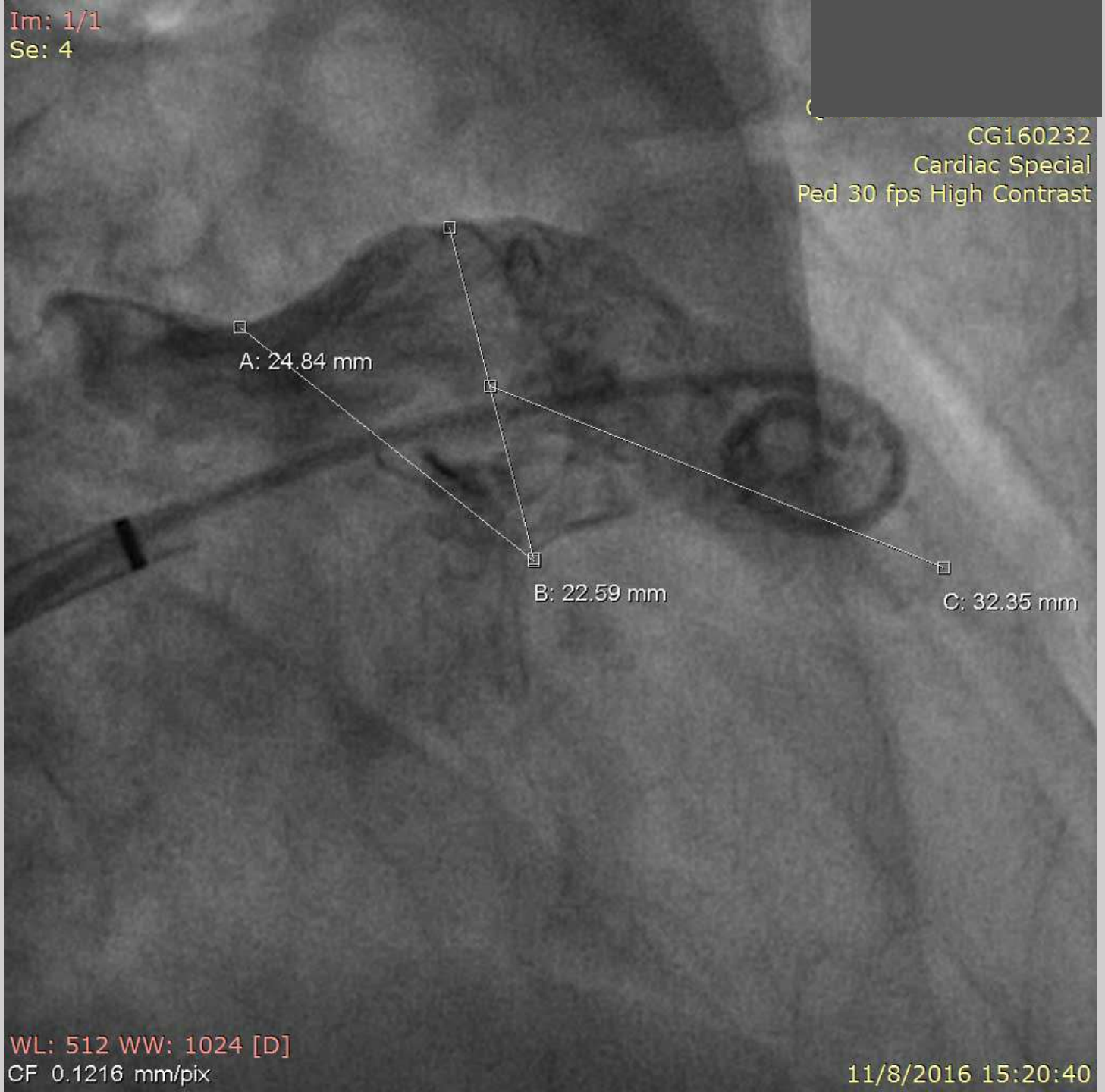
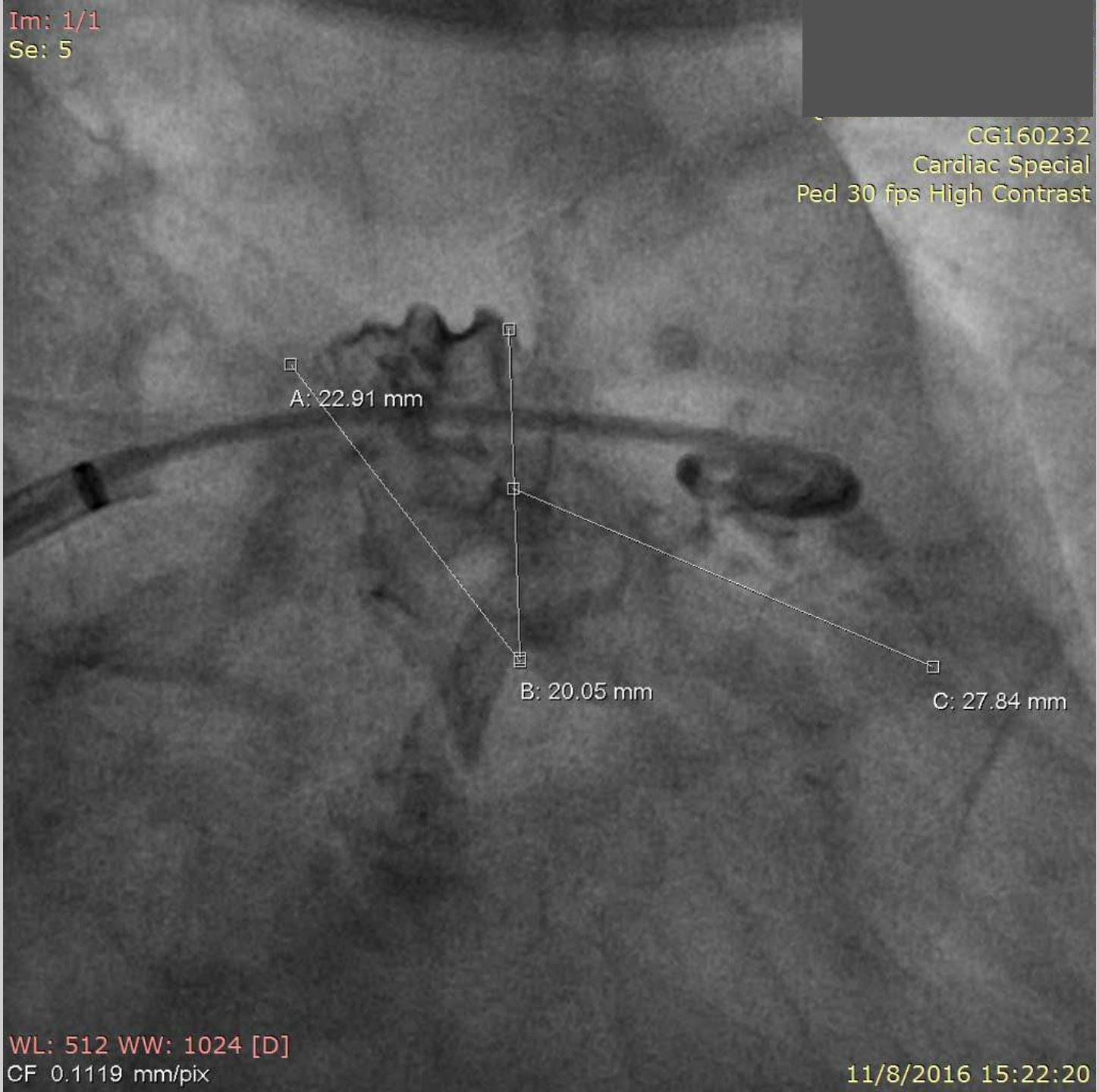
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 222 [D]
RAO: 30 CAU: 20
11/8/2016 15:22:19


Im: 1/1
Se: 4
CG160232
Cardiac Special
Ped 30 fps High Contrast
A: 24.84 mm
B: 22.59 mm
C: 32.35 mm
WL: 512 WW: 1024 [D]
CF 0.1216 mm/pix
11/8/2016 15:20:40


Im: 1/1
Se: 5
CG160232
Cardiac Special
Ped 30 fps High Contrast
A: 22.91 mm
B: 20.05 mm
C: 27.84 mm
WL: 512 WW: 1024 [D]
CF 0.1119 mm/pix
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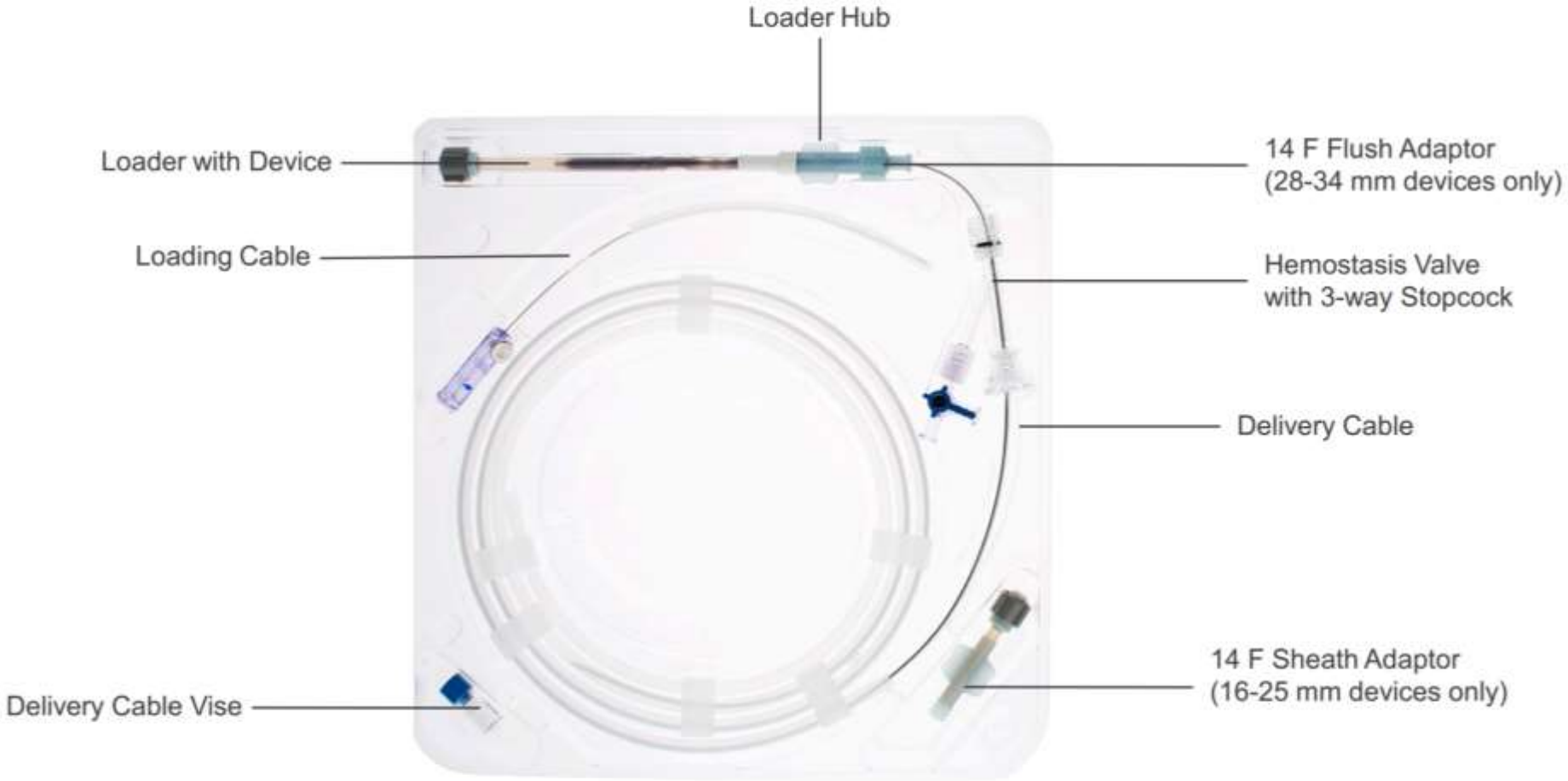
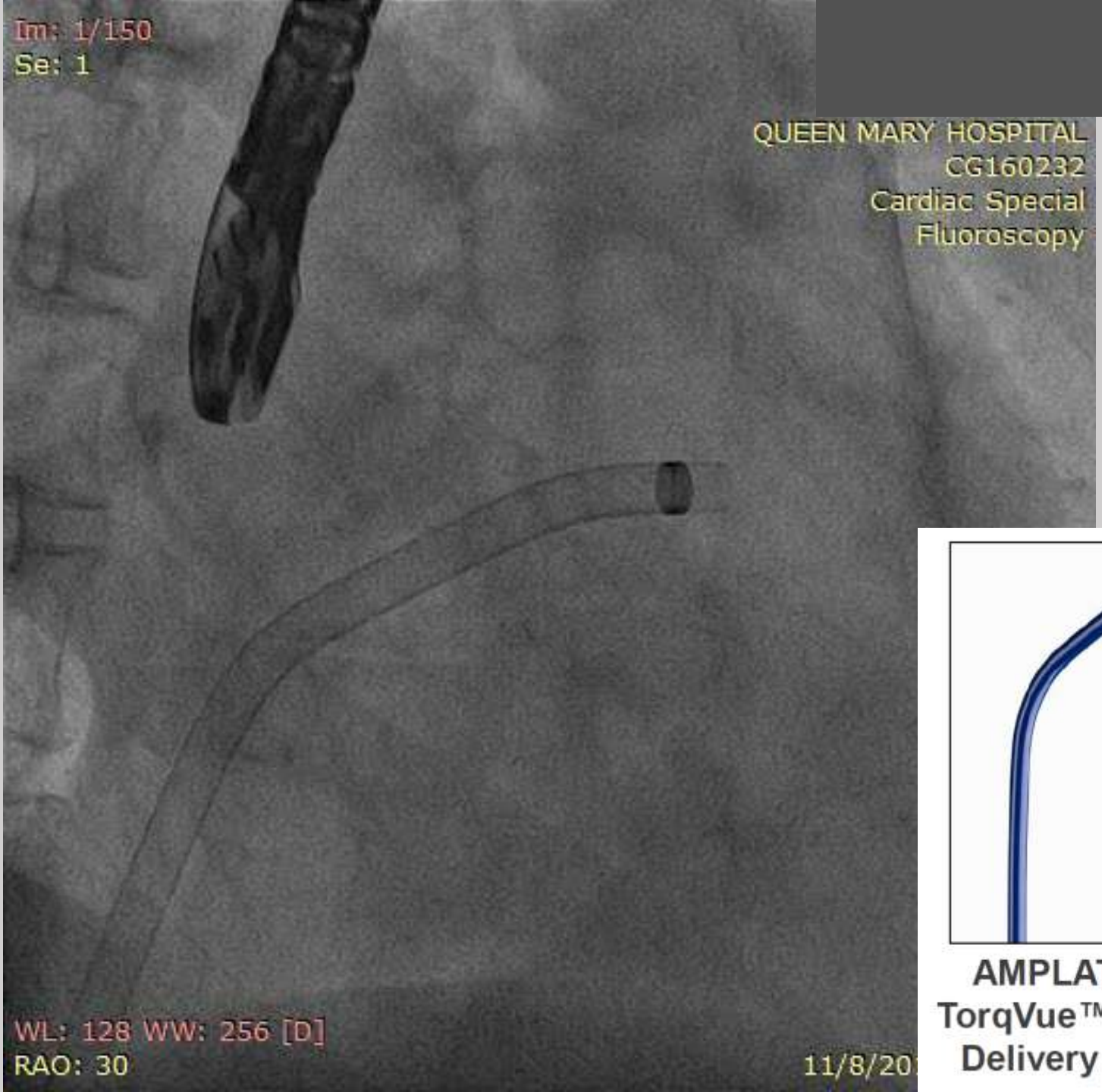
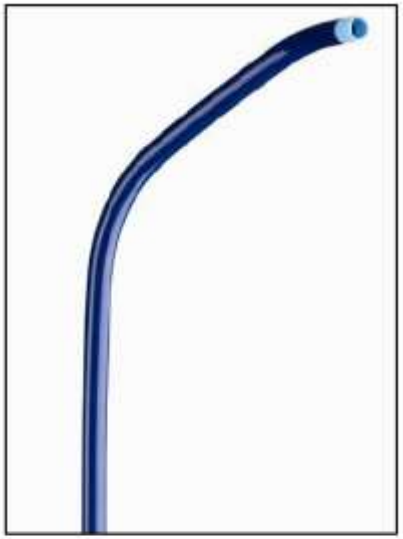
Device Package Components




Im: 1/150
Se: 1
QUEEN MARY HOSPITAL
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30
11/8/2016 15:31:23





AMPLATZER™
TorqVue™ 45°x 45°
Delivery System


Im: 1/21
Se: 1
QUEEN MARY HOSPITAL
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30
11/8/2016 15:37:58


Im: 1/41
Se: 1
QUEEN MARY HOSPITAL
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20
11/8/2016 15:39:42


Im: 1/43
Se: 1
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CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20
PHILIPS
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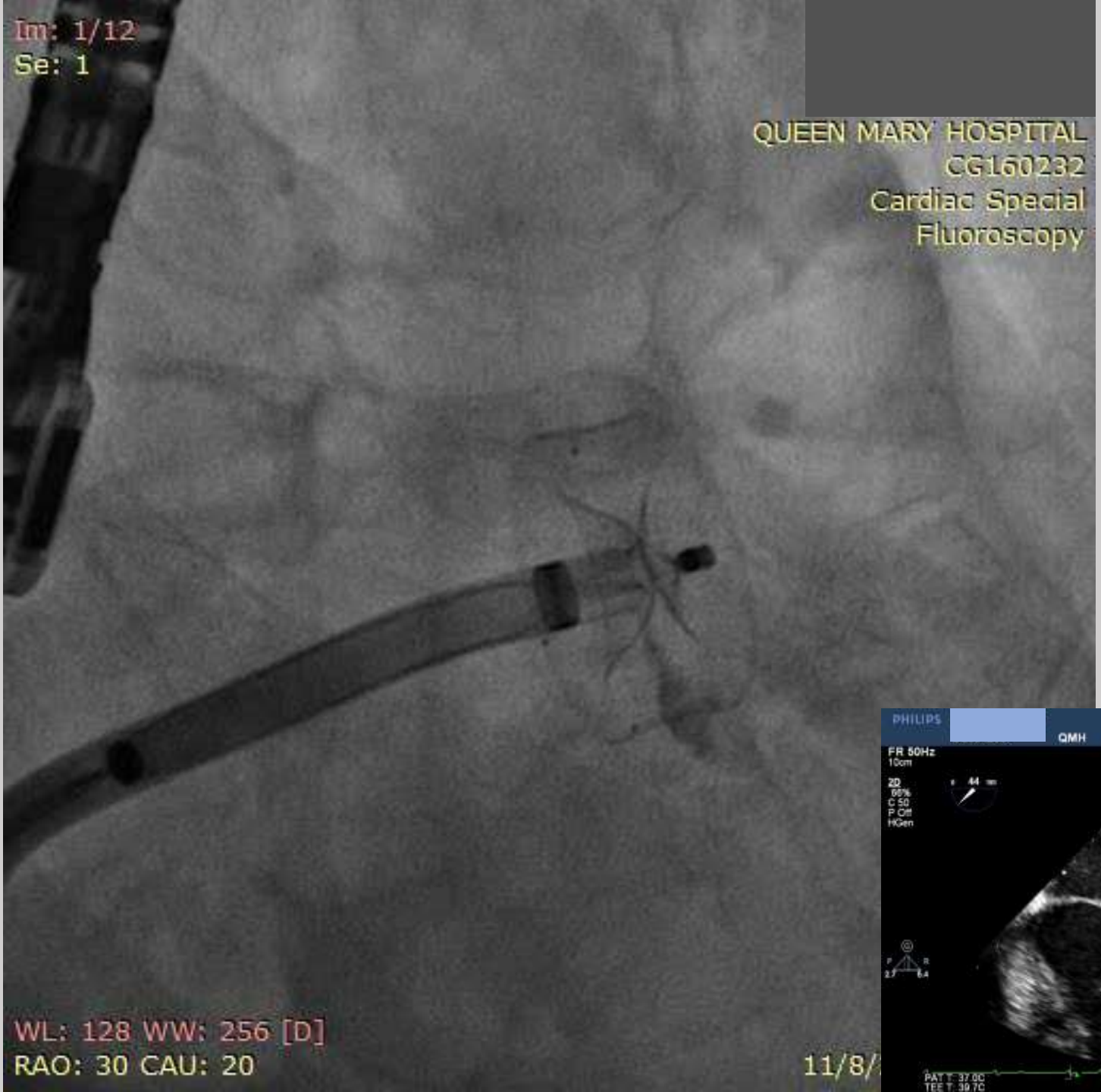
10cm
2D
C 50
P Off
HGen
64bpm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CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20
11/8/


PHILIPS
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QMH
X7-2t/Adult
FR 50Hz
10cm
2D
C 50
P Off
HGen
58bpm


Im: 1/39
Se: 1
QUEEN MARY HOSPITAL
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20
PHILIPS
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X7-2t/Adult
FR 50Hz
10cm
2D
68%
C 50
P Off
HGen
74 ms
PAT T: 37.0C
TEE T: 39.0C
60 bpm


Im: 1/150
Se: 1
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CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20
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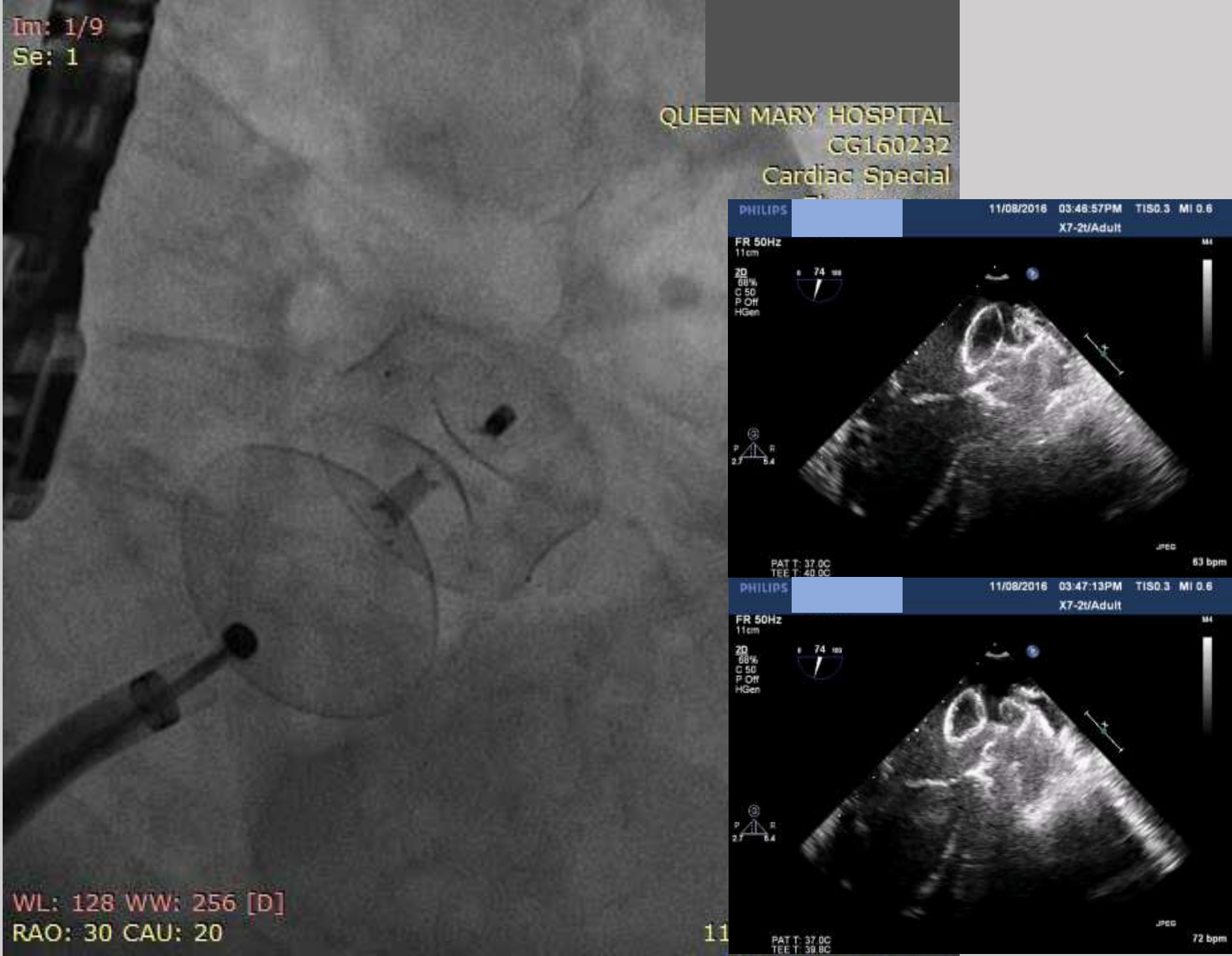
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CG160232
Cardiac Special
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X7-2t/Adult
FR 50Hz
11cm
2D
68%
C 50
P Off
HGen
74
PAT T: 37.0C
TEE T: 40.0C
63 bpm
PHILIPS
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X7-2t/Adult
FR 50Hz
11cm
2D
68%
C 50
P Off
HGen
74
PAT T: 37.0C
TEE T: 39.8C
72 bpm
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20


Im: 1/53
Se: 1
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Fluoroscopy
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RAO: 30 CAU: 20
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11cm
74 ms
60 bpm


Im: 1/50
Se: 1
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Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CRA: 20
11/8/2016 15:44:31


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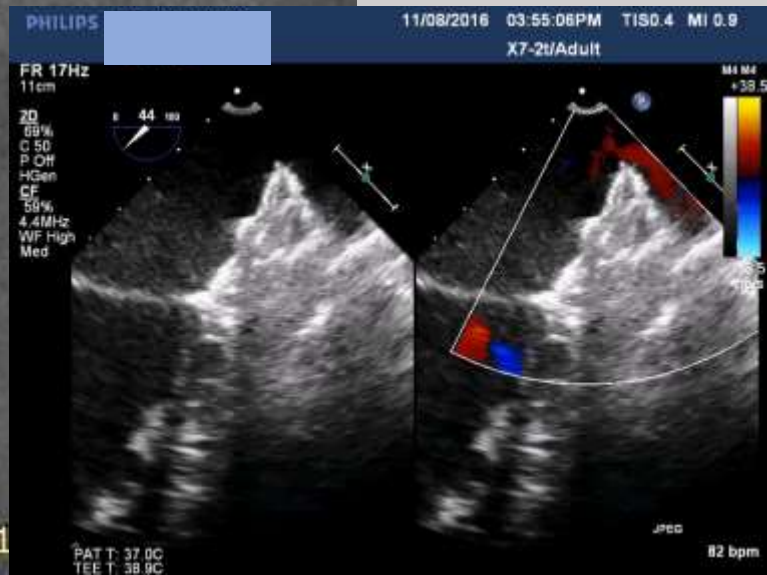
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20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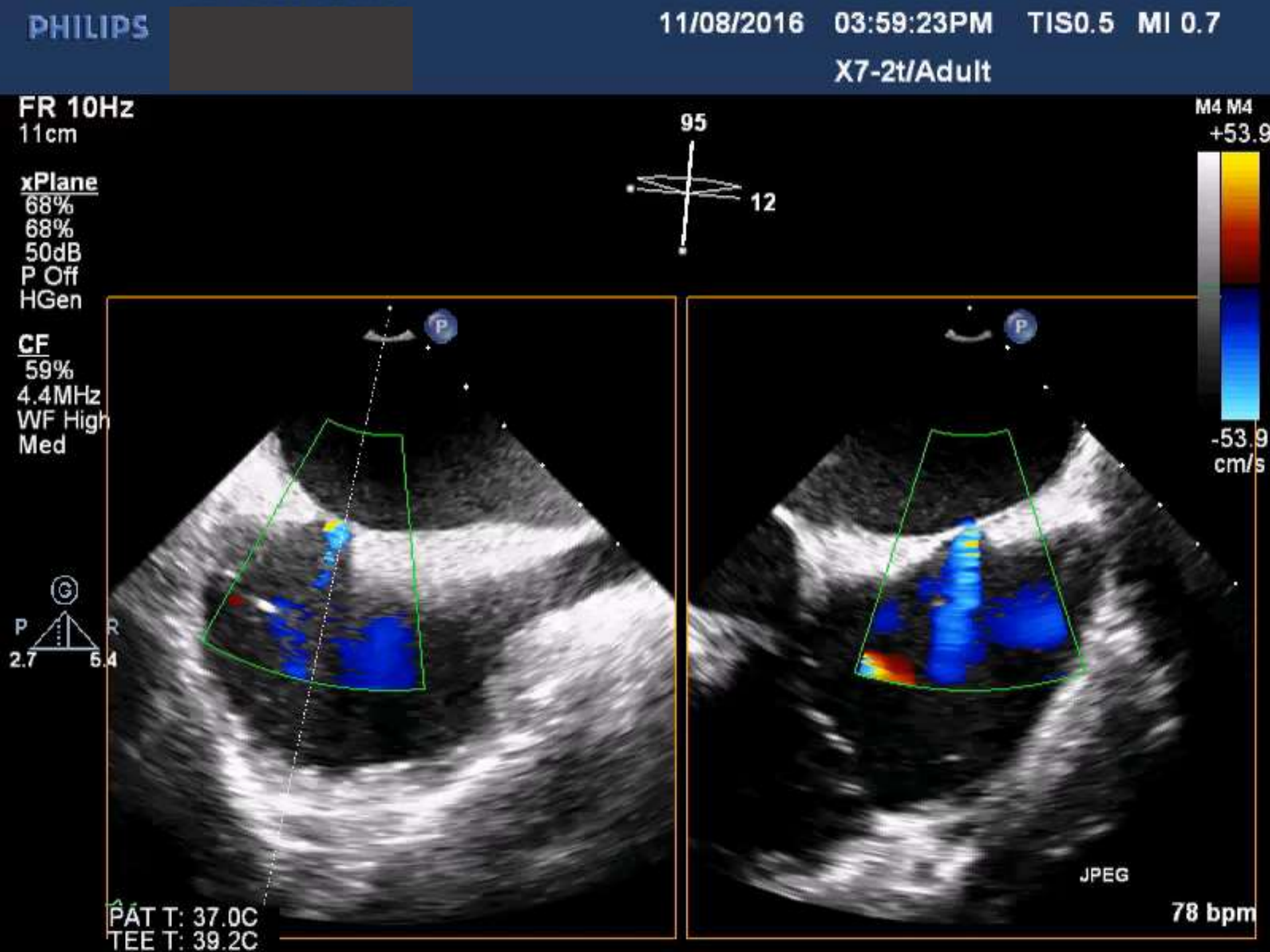
FR 17Hz
11cm
2D
C 50
P Off
HGen
CF
4.4MHz
WF High
Med
82 bpm


Im: 1/47
Se: 1
QUEEN MARY HOSPITAL
CG160232
Cardiac Special
Fluoroscopy
WL: 128 WW: 256 [D]
RAO: 30 CRA: 20
PHILIPS
11/08/2016 04:02:53PM TIS0.4 MI 1.0
X7-2t/Adult
FR 6Hz
6.6cm
3D Beats 1
3D
3D 47%
3D 40dB
75
JPEG
61 bpm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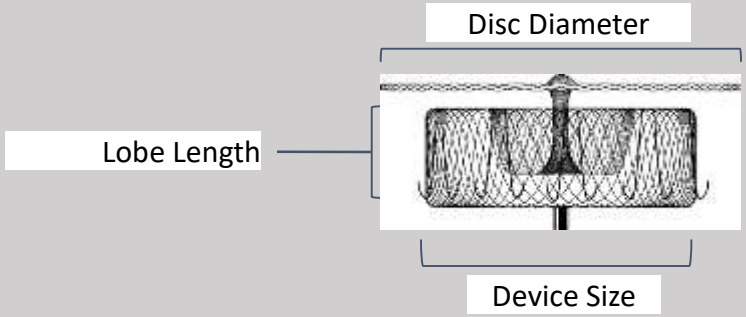
xPlane
68%
68%
50dB
P Off
HGen
CF
59%
4.4MHz
WF High
Med
95
12
M4 M4
+53.9
-53.9
cm/s
P
R
2.7
6.4
PAT T: 37.0C
TEE T: 39.2C
JPEG
78 bpm

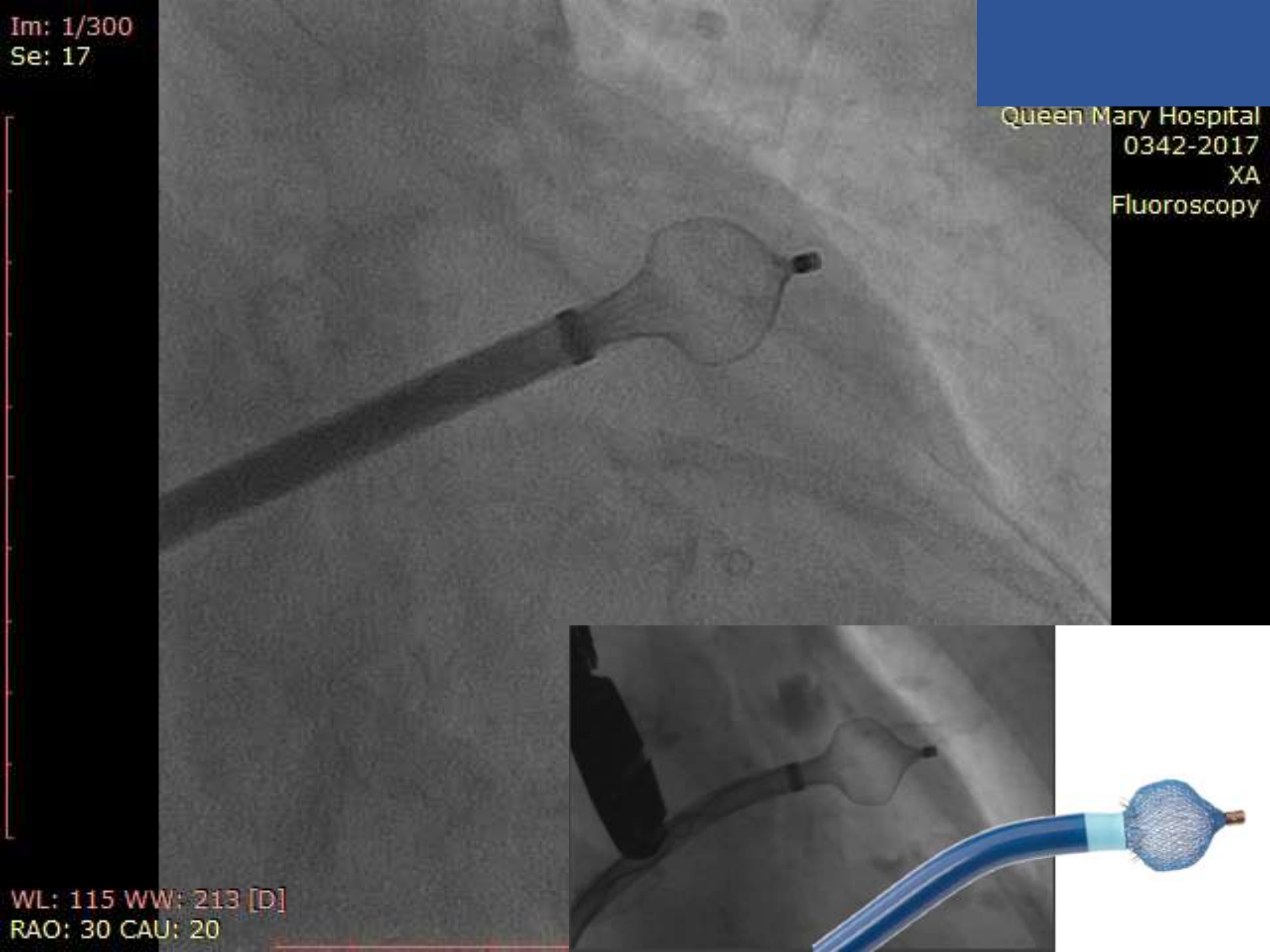
A2

Device Size Selection - Amulet

Maximum Landing Zone Width (mm)	Amulet™Device Size	Lobe Length (mm)	Minimum LAA Depth (mm)	Disc Diameter (mm)	Sheath Diameter
11.0-13.0	**16**	7.5	≥ 10	22	12 F *or* 14 F (with adaptor)
13.0-15.0	**18**	7.5	≥ 10	24	
15.0-17.0	**20**	7.5	≥ 10	26	
17.0-19.0	**22**	7.5	≥ 10	28	
19.0-22.0	**25**	10	≥ 12	32	
22.0-25.0	**28**	10	≥ 12	35	14 F
25.0-28.0	**31**	10	≥ 12	38	
28.0-31.0	**34**	10	≥ 12	41	




Im: 1/57
Landing Zone 25mm
AMULET #28mm
Queen Mary Hospital
0342-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
10/3/2017 17:14:25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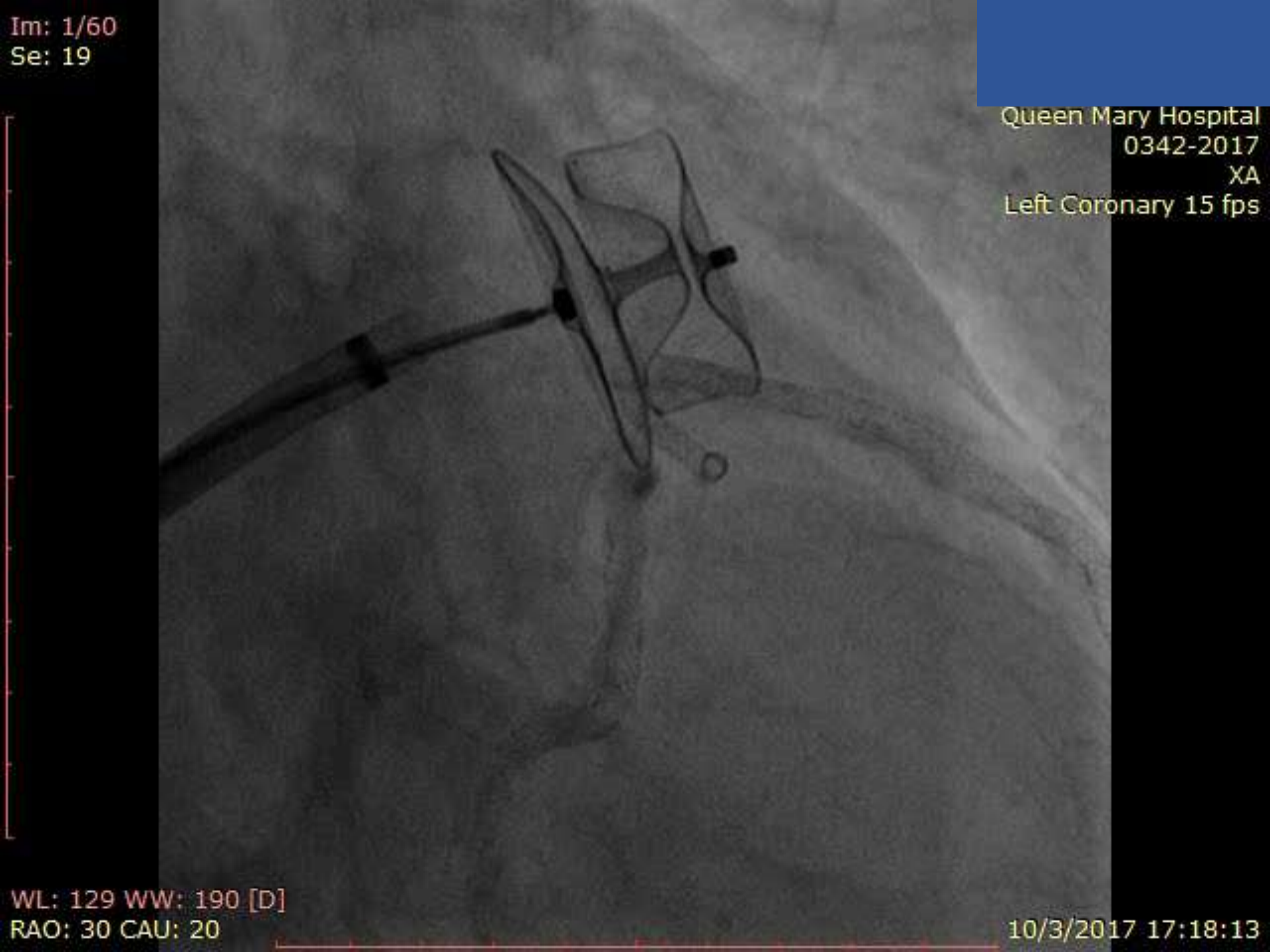
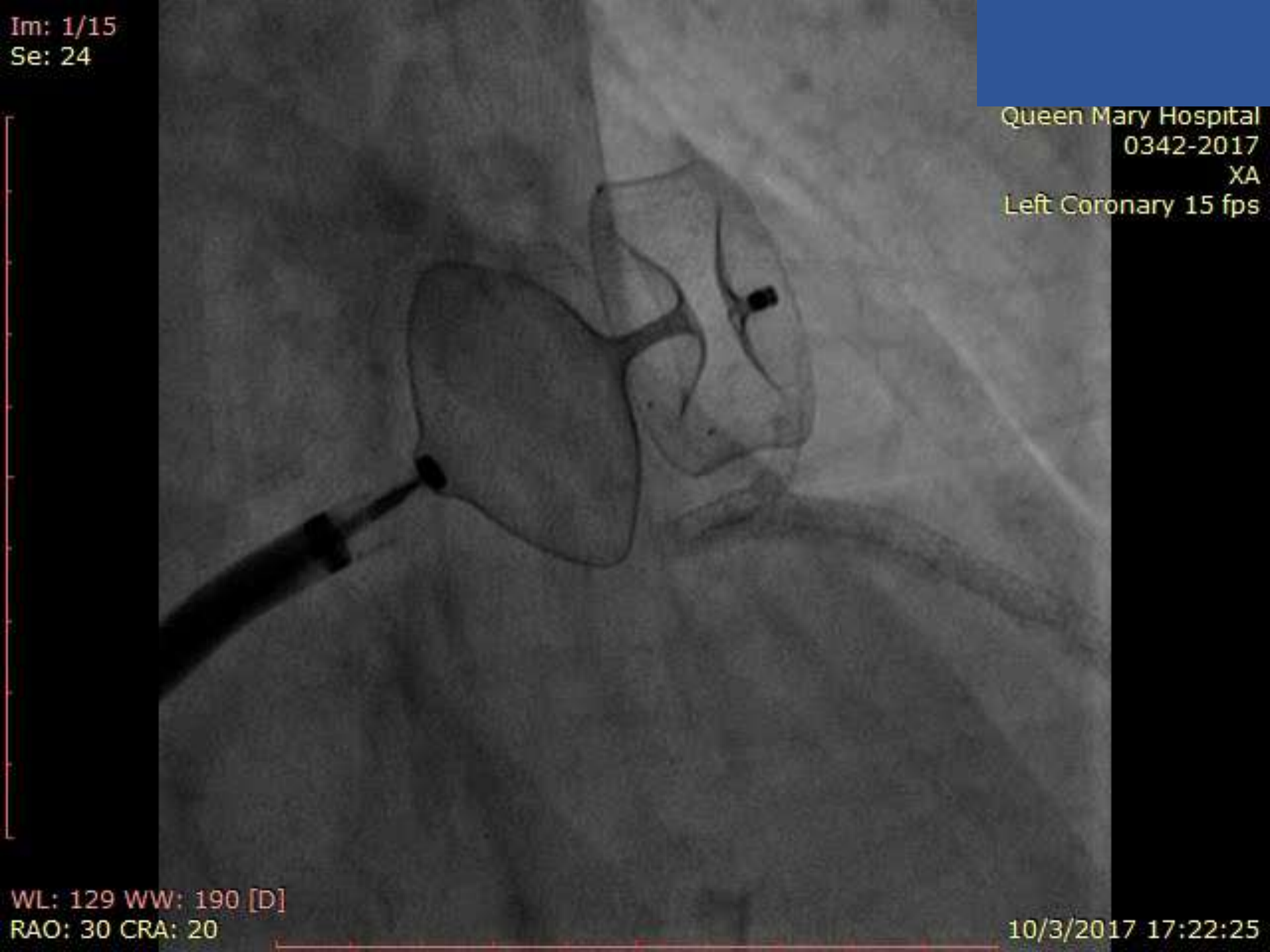
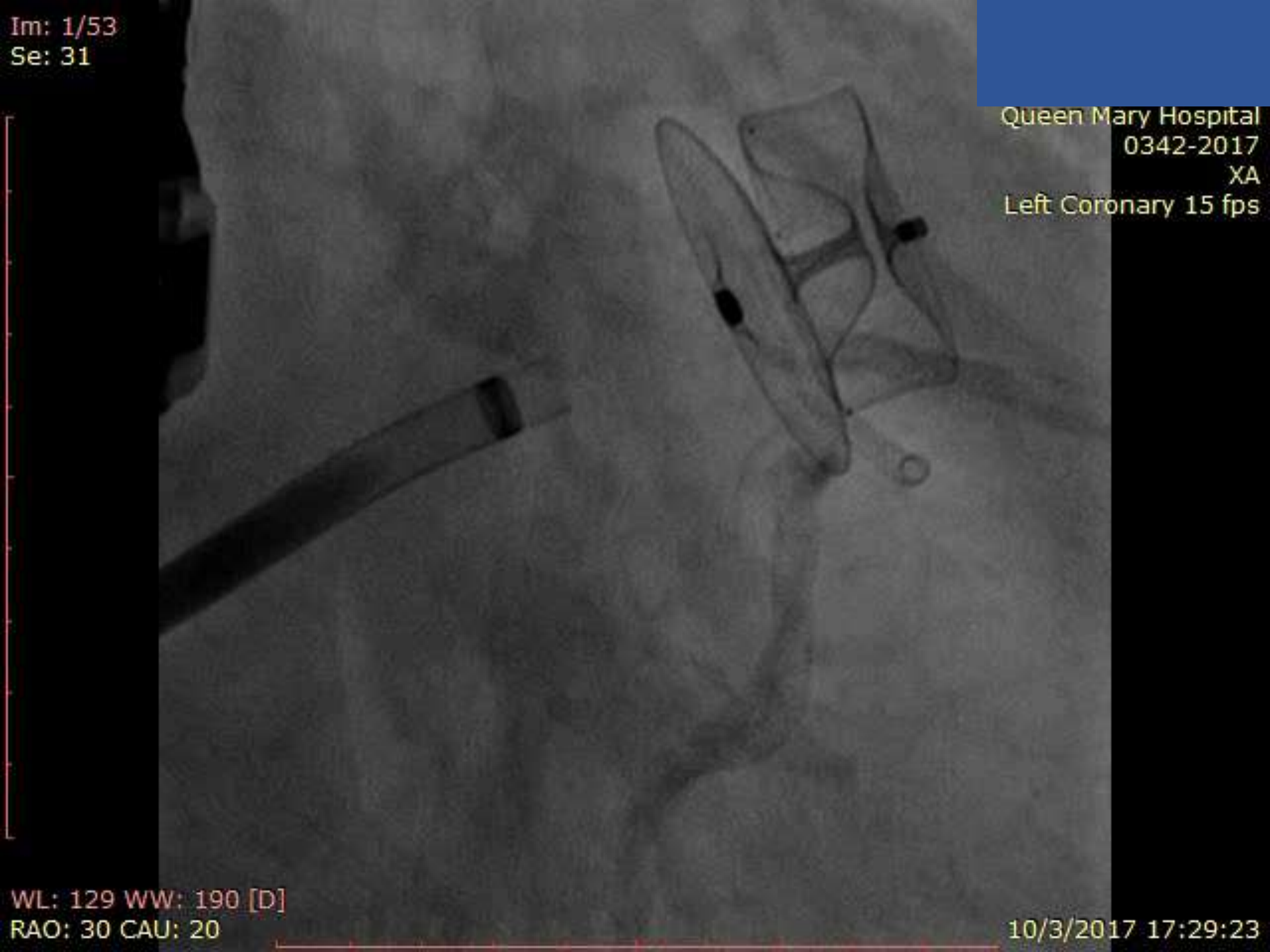
Se: 17
Queen Mary Hospital
0342-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
RAO: 30 CAU: 20


Im: 1/300
Se: 18
Queen Mary Hospital
0342-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
RAO: 30 CAU: 20
10/3/2017 17:17:21


Im: 1/60
Se: 19
Queen Mary Hospital
0342-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
10/3/2017 17:18:13


Im: 1/15
Se: 24
Queen Mary Hospital
0342-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CRA: 20
10/3/2017 17:22:25


Im: 1/53
Se: 31
Queen Mary Hospital
0342-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
10/3/2017 17:29:23

A3


Im: 1/91
Se: 24
QUEEN MARY HOSPITAL
CG160207
EP 15 fps
PHILIPS
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X7-2t/Adult
FR 50Hz
12cm
2D
64%
C 50
P Off
HGen
23
M4
JPEG
60 bpm
PAT T: 37.0C
TEE T: 39.9C
WL: 128 WW: 256 [D]
RAO: 30 CAU: 19


Im: 1/9
Se: 25
QUEEN MARY HOSPITAL
CG160207
EP 15 fps
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X7-2t/Adult
FR 50Hz
12cm
2D
64%
C 50
P Off
HGen
MI
PAT T: 37.0C
TEE T: 39.9C
73 bpm
WL: 128 WW: 256 [D]
RAO: 30 CAU: 19


Im: 1/17
Se: 29
QUEEN MARY HOSPITAL
CG160207
EP 15 fps
PHILIPS
22/07/2016 01:22:22PM TIS0.4 MI 1.0
X7-2t/Adult
FR 9Hz
6.8cm
3D Beats 1
3D
3D 47%
3D 40dB
35
M4
JPEG
83 bpm
PAT T: 37.0C
TEE T: 40.0C
WL: 128 WW: 256 [D]
RAO: 30 CAU: 20

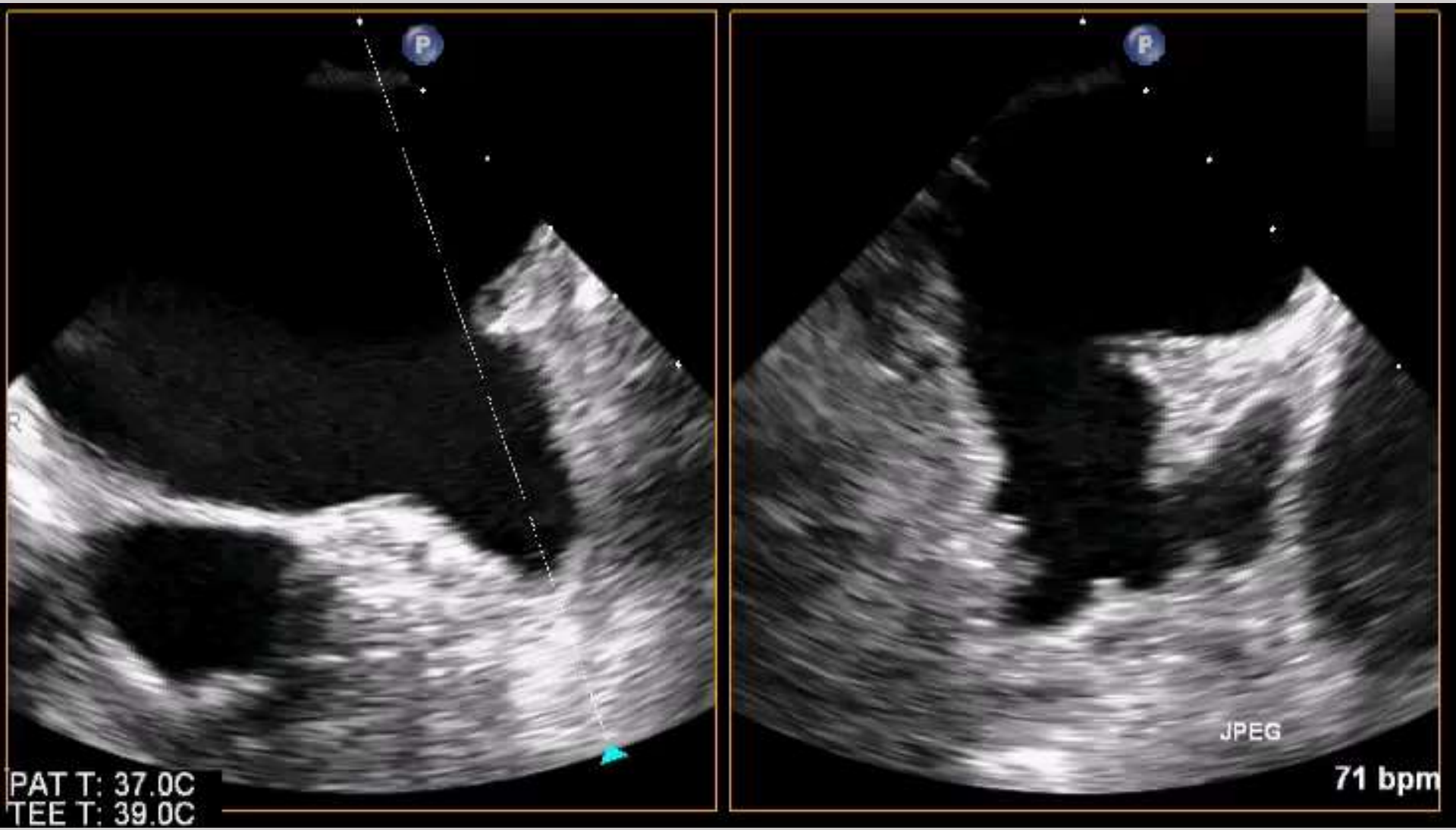
LAMBRE

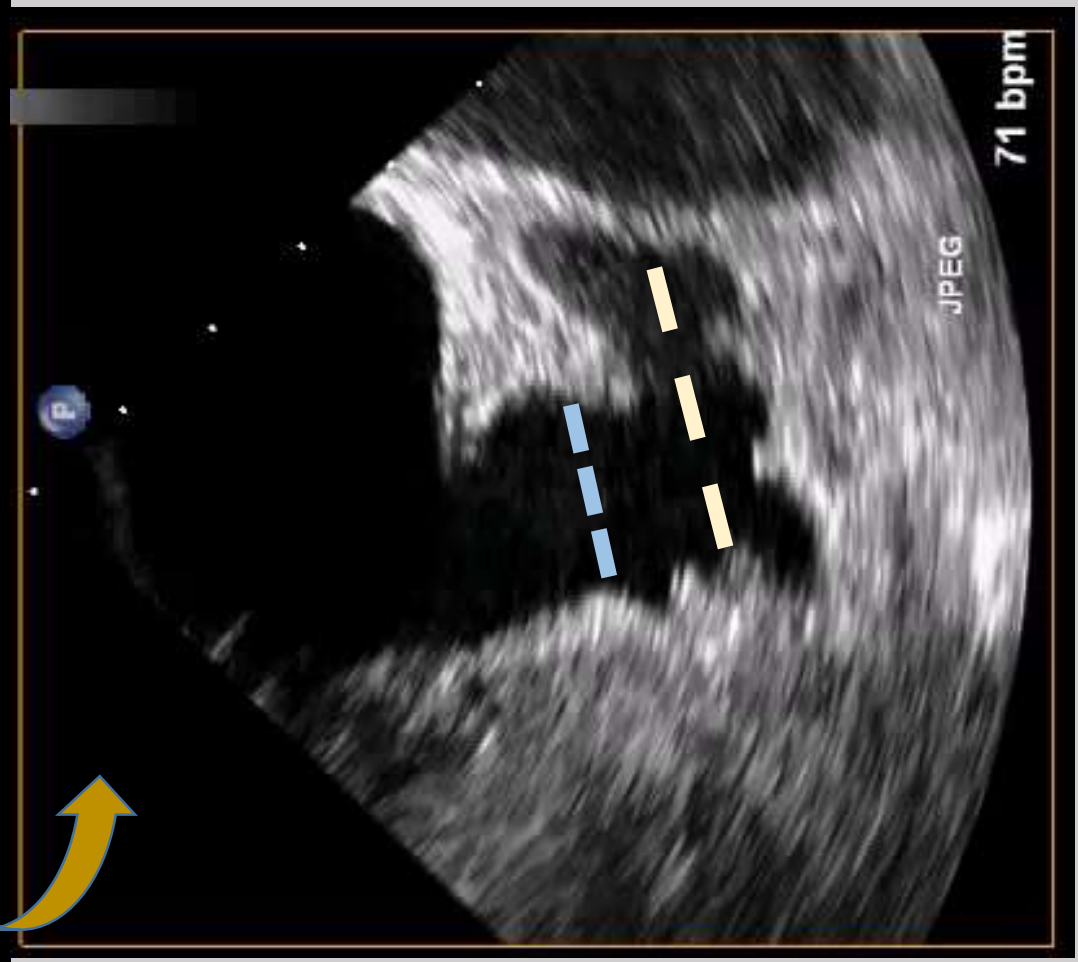
L1

HKU Med

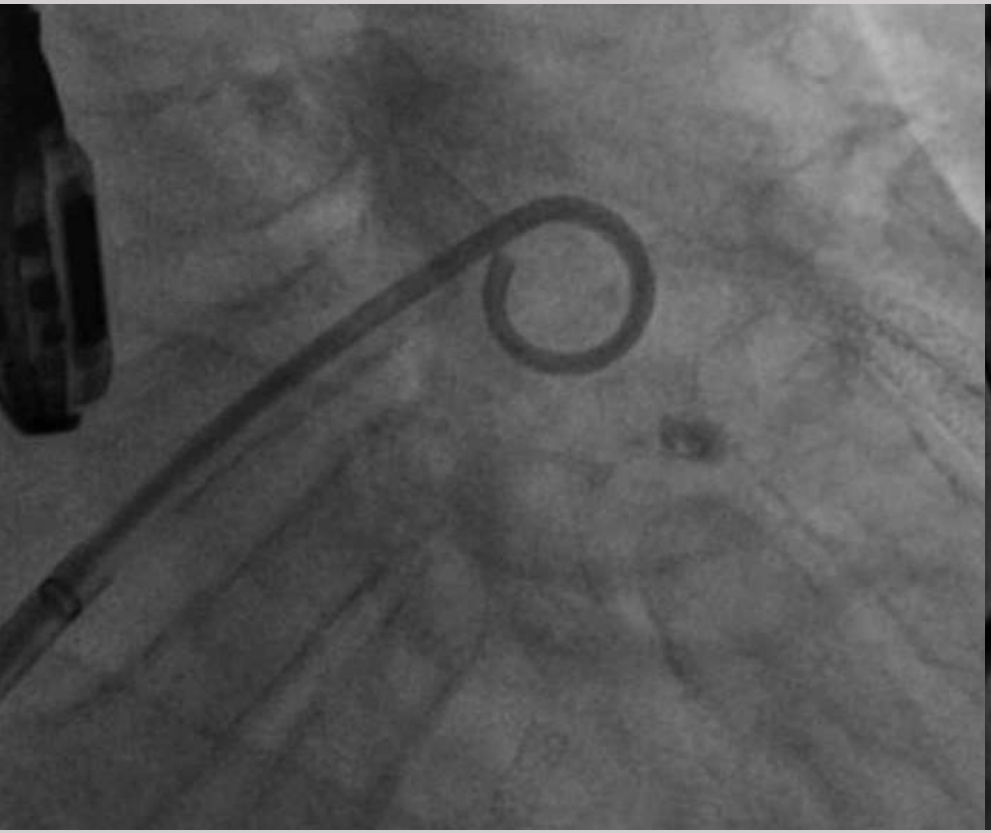
- ACP/LAMBRE in poor defined landing zone/chicken wing anatomy with short neck – **Sandwich technique**
  - overcome challenging anatomies
  - extreme chicken wing type
  - secured position
  - forgiving extreme angles

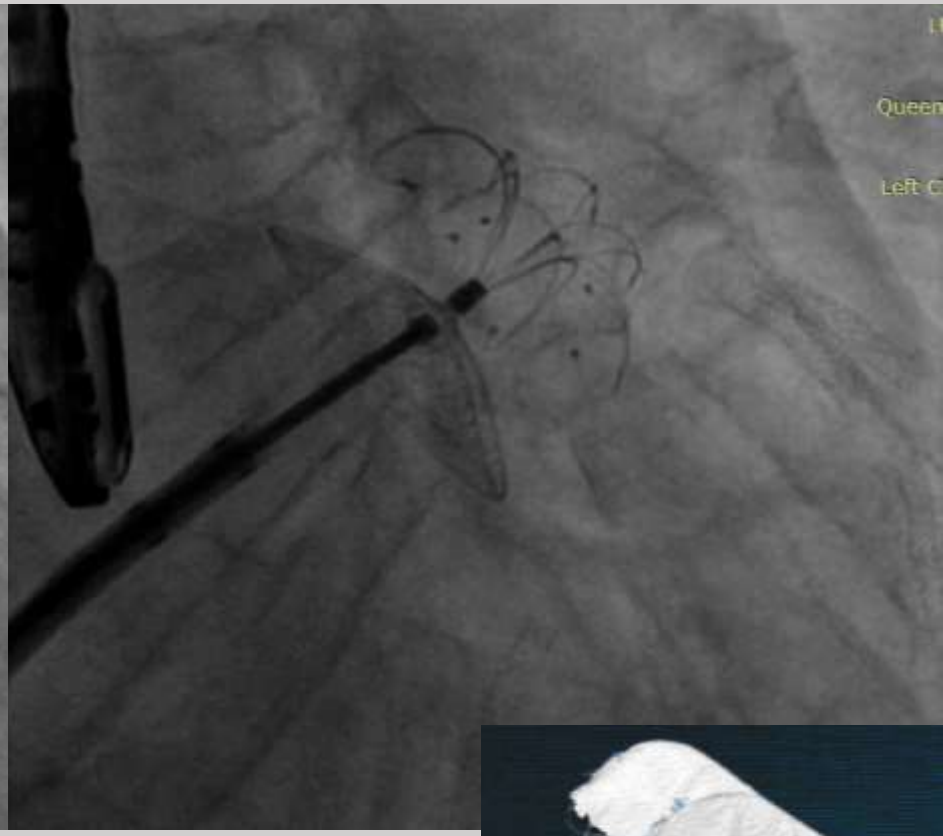
HKU Med


PAT T: 37.0C
TEE T: 39.0C
JPEG
71 bpm



TEE 135 correlates with RAO 30 CRAU 20



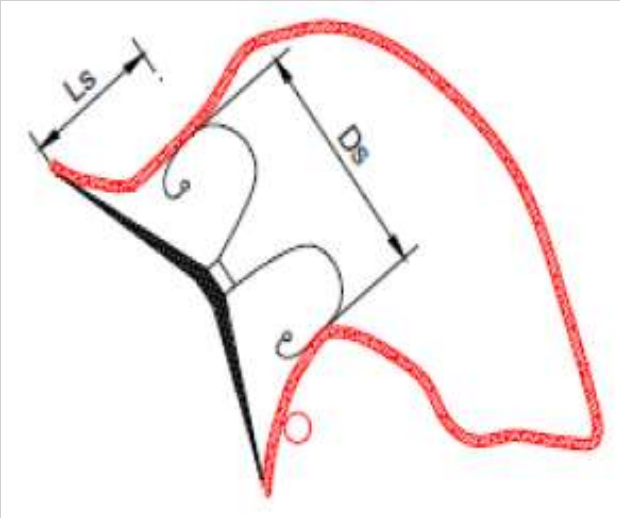

Queen
Left C

L2

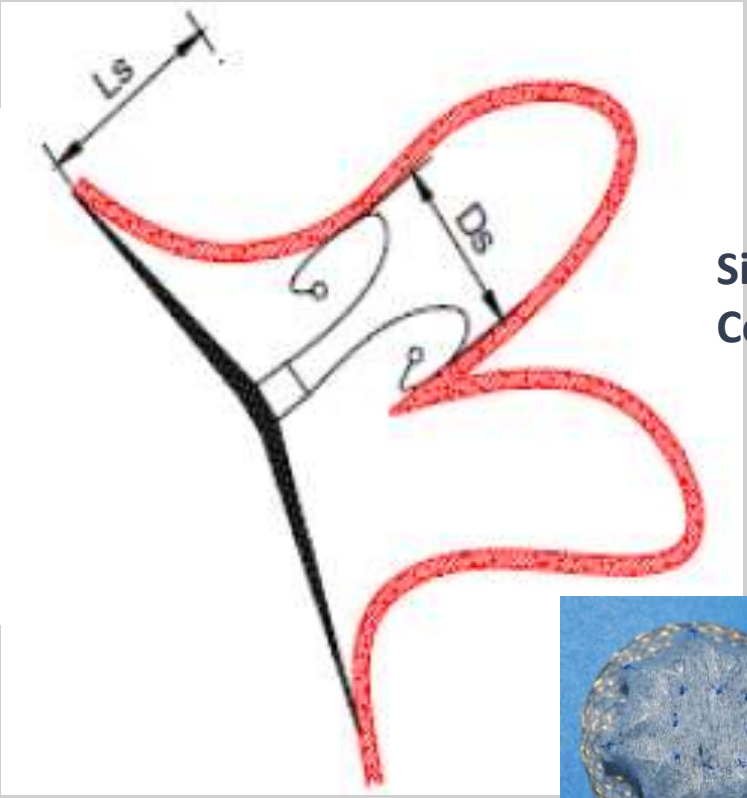
HKU Med

Special LAA Morphology

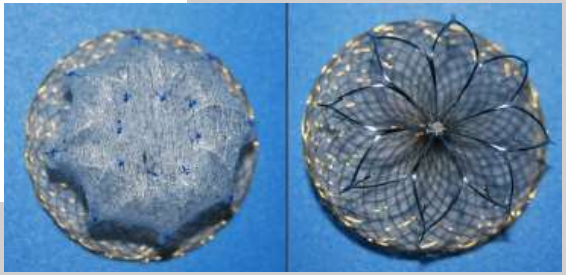
- Small LAA
- LAA with multiple lobes and restrictive septum
- Special design of **LAmbre Device**

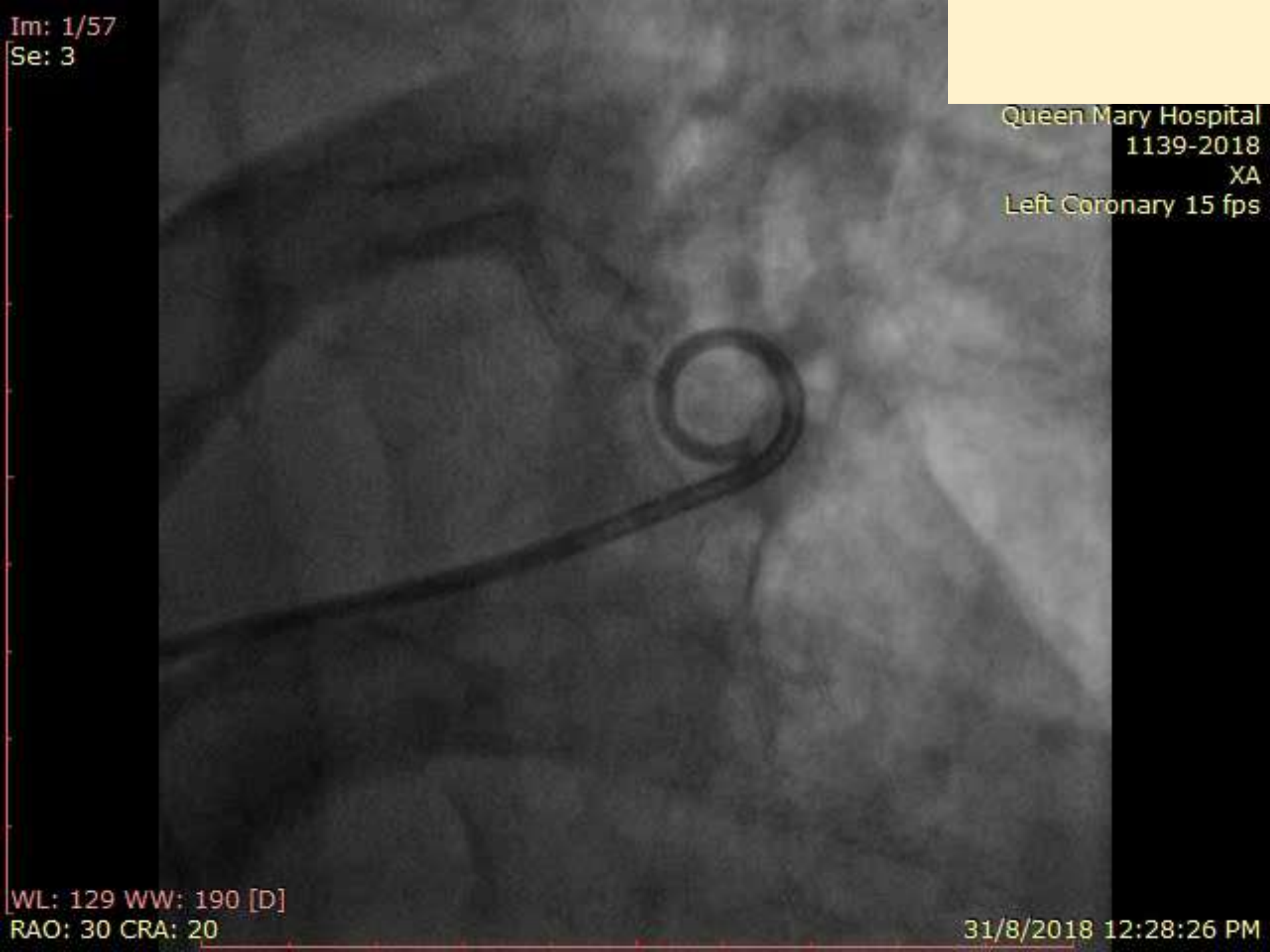


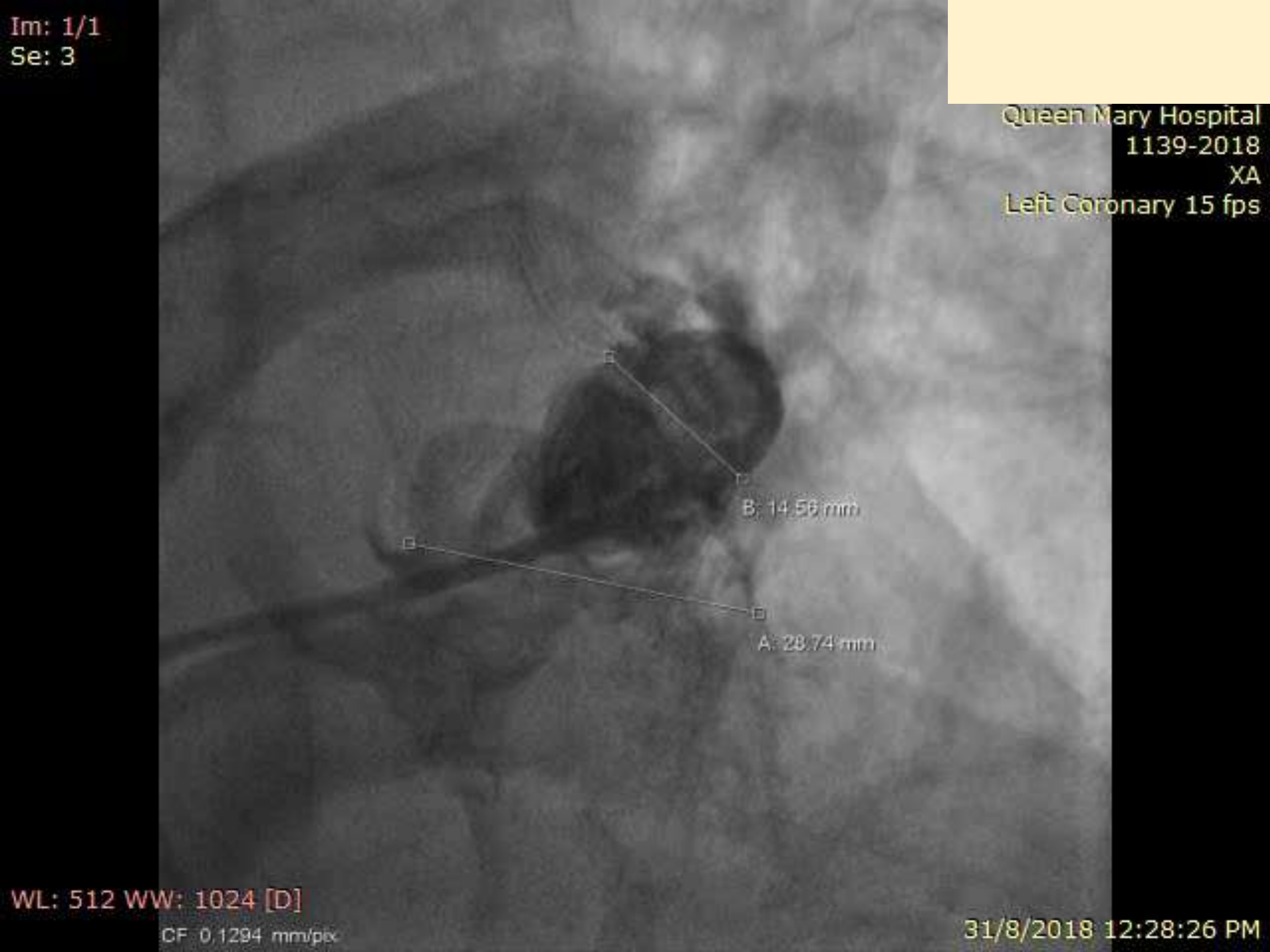
Size: 16-36mm
Cover 4-6mm larger

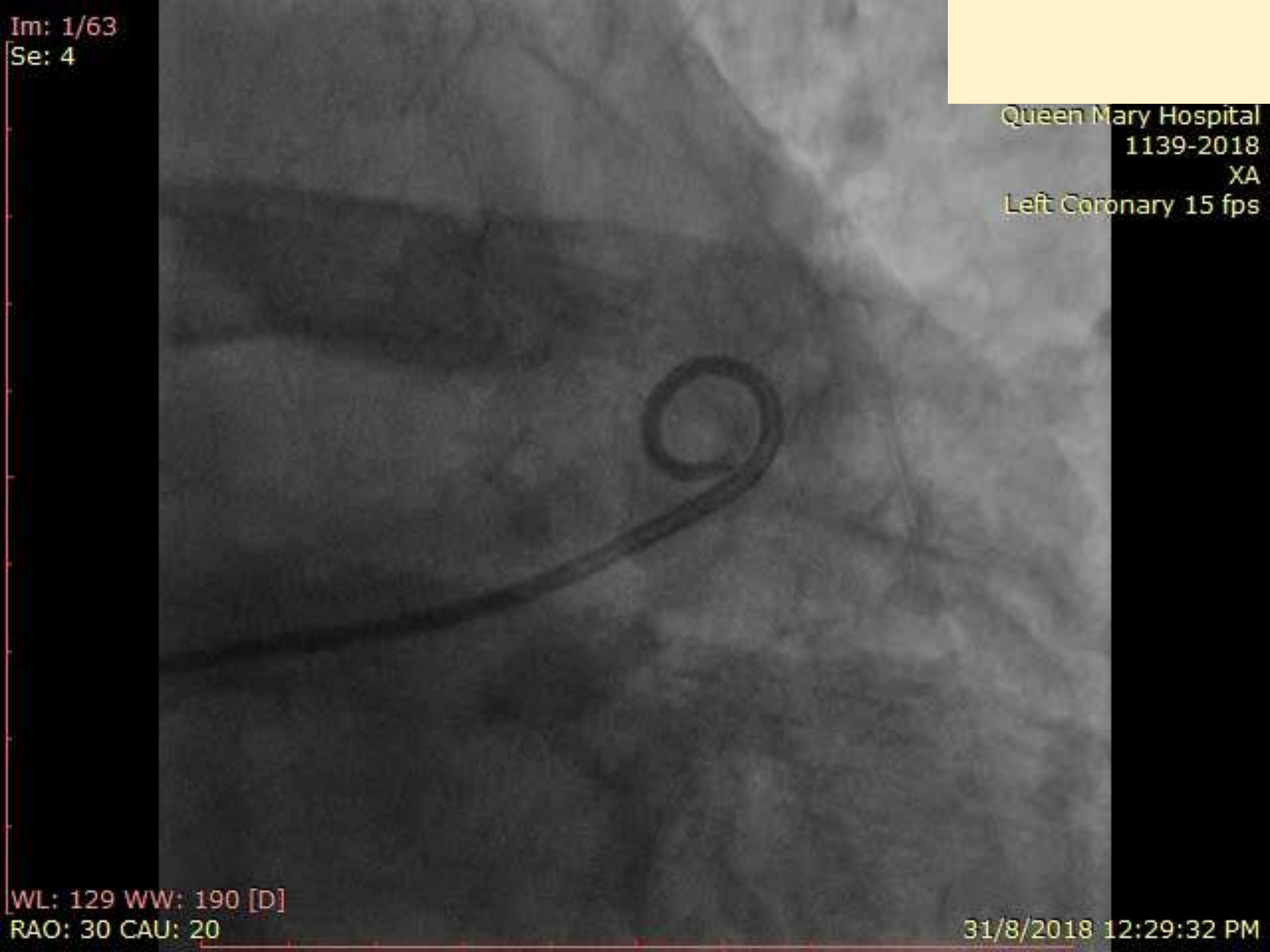


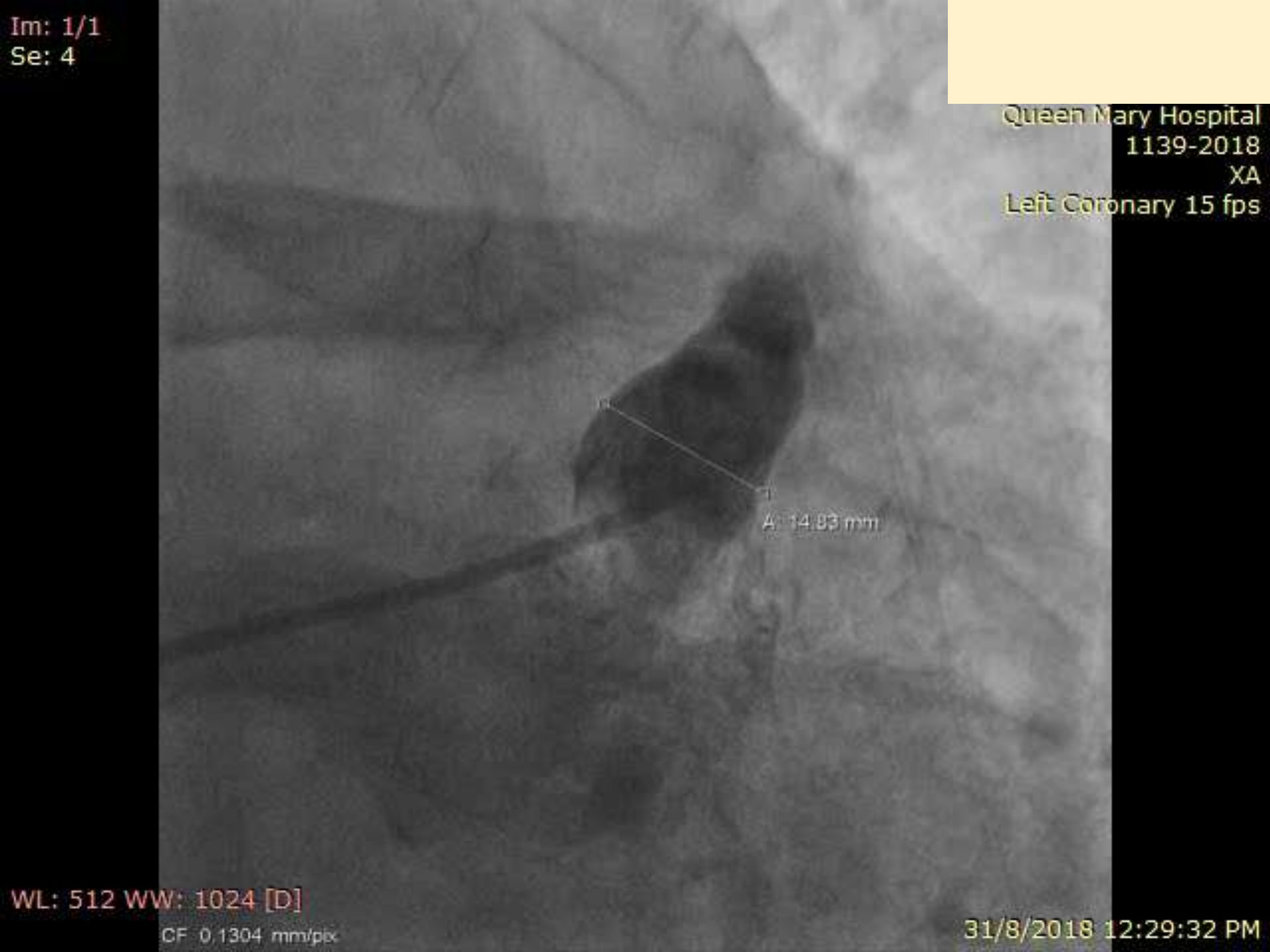
Size: 16-26mm
Cover 12mm larger



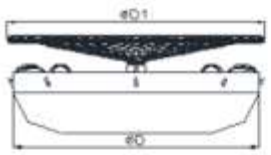

Im: 1/57
Se: 3
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CRA: 20
31/8/2018 12:28:26 PM

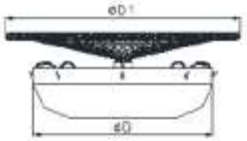

Im: 1/1
Se: 3
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
B: 14.56 mm
A: 28.74 mm
WL: 512 WW: 1024 [D]
CF 0.1294 mm/pix
31/8/2018 12:28:26 PM


Im: 1/63
Se: 4
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
31/8/2018 12:29:32 PM


Im: 1/1
Se: 4
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
A: 14.83 mm
WL: 512 WW: 1024 [D]
CF 0.1304 mm/pix
31/8/2018 12:29:32 PM

Device Sizes and Corresponding Delivery Systems of LAmbre

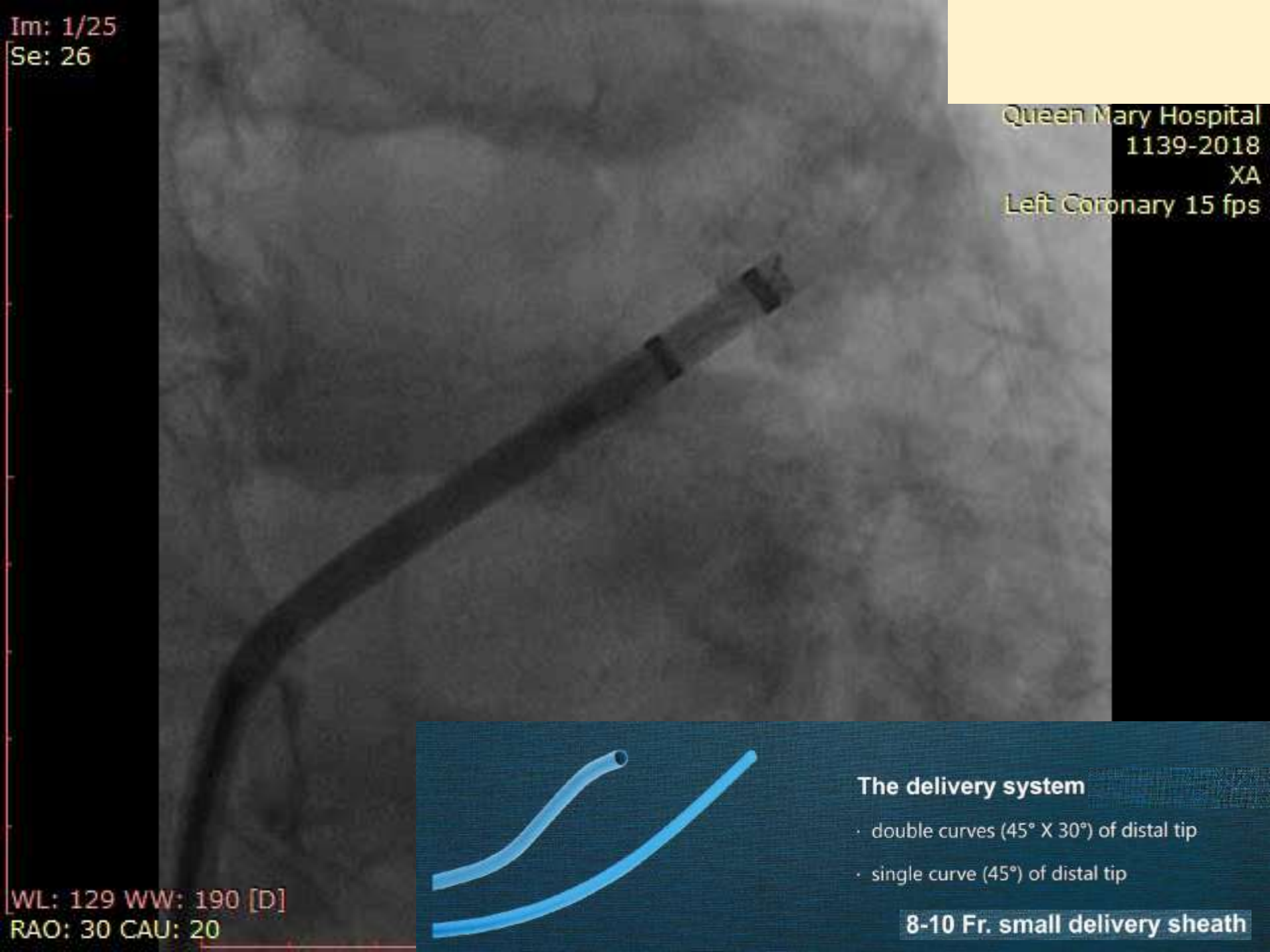




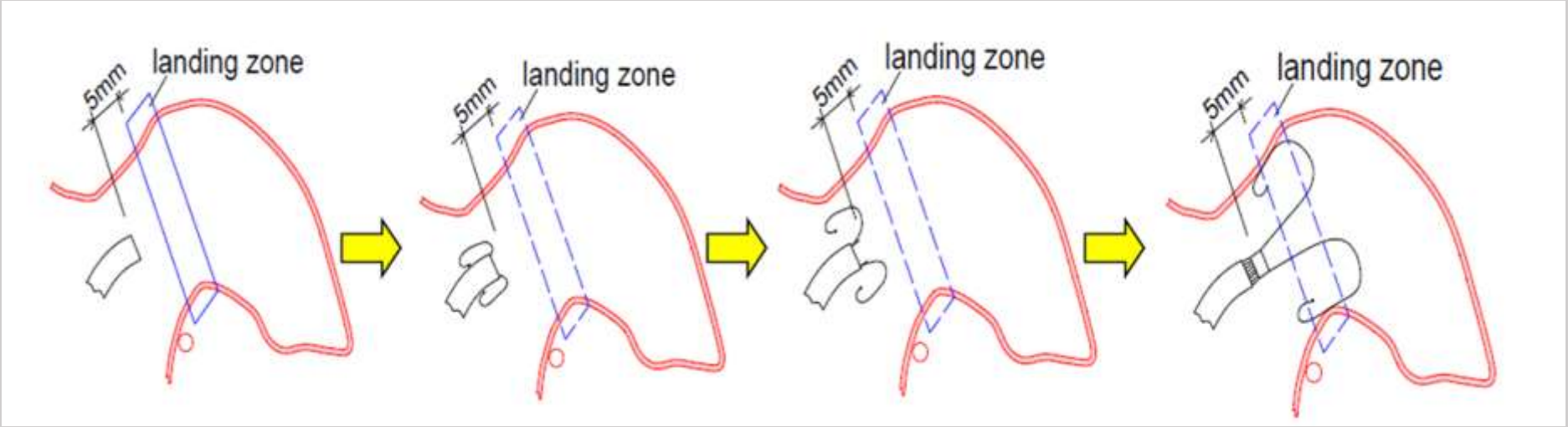
Cat.	Diameter of Umbrella(mm)	Diameter of Cover(mm)	Delivery system
LT-LAA-1622	16	22	8F-900 9F-900 10F-900
LT-LAA-1824	18	24	
LT-LAA-2026	20	26	9F-900 10F-900
LT-LAA-2228	22	28	
LT-LAA-2430	24	30	
LT-LAA-2632	26	32	10F-900
LT-LAA-2834	28	34	
LT-LAA-3036	30	36	
LT-LAA-3236	32	36	
LT-LAA-3438	34	38	
LT-LAA-3640	36	40	

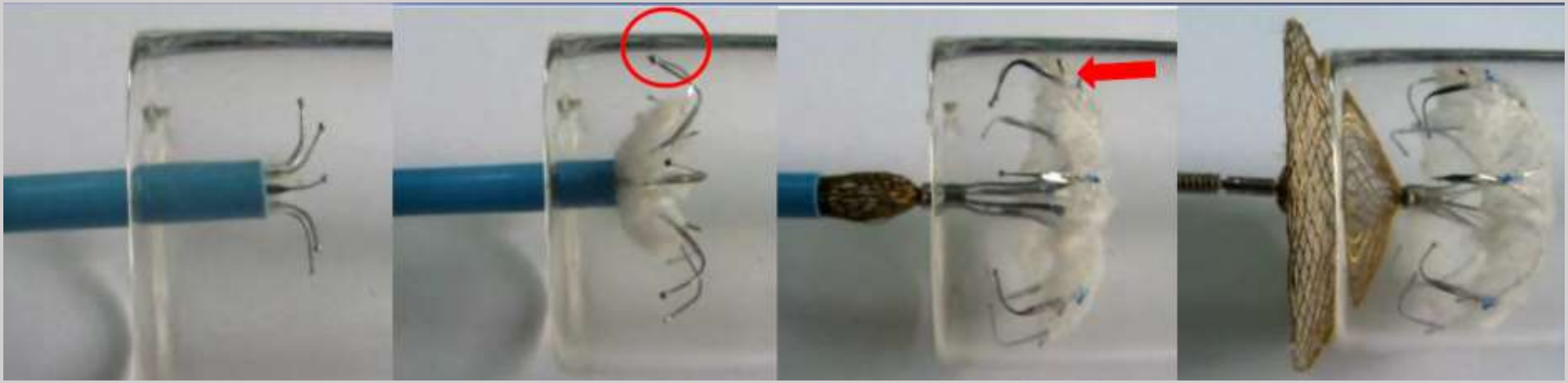
Cat.	Diameter of Umbrella(mm)	Diameter of Cover(mm)	Delivery system
LT-LAA-1630	16	30	9F-900 10F-900
LT-LAA-1832	18	32	10F-900
LT-LAA-2032	20	32	
LT-LAA-2234	22	34	
LT-LAA-2436	24	36	
LT-LAA-2638	26	38	


PHILIPS
31/08/2018 12:12:14 TIS0.3 MI 0.6
X7-2t/Adult
FR 50Hz
11cm
M4
2D
69%
C 50
P Off
HGen
0 70 180
P
G
P R
2.7 5.4
JPEG
72 bpm
PAT T: 37.0C
TEE T: 39.1C


Im: 1/25
Se: 26
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
The delivery system
· double curves (45° X 30°) of distal tip
· single curve (45°) of distal tip
8-10 Fr. small delivery sheath

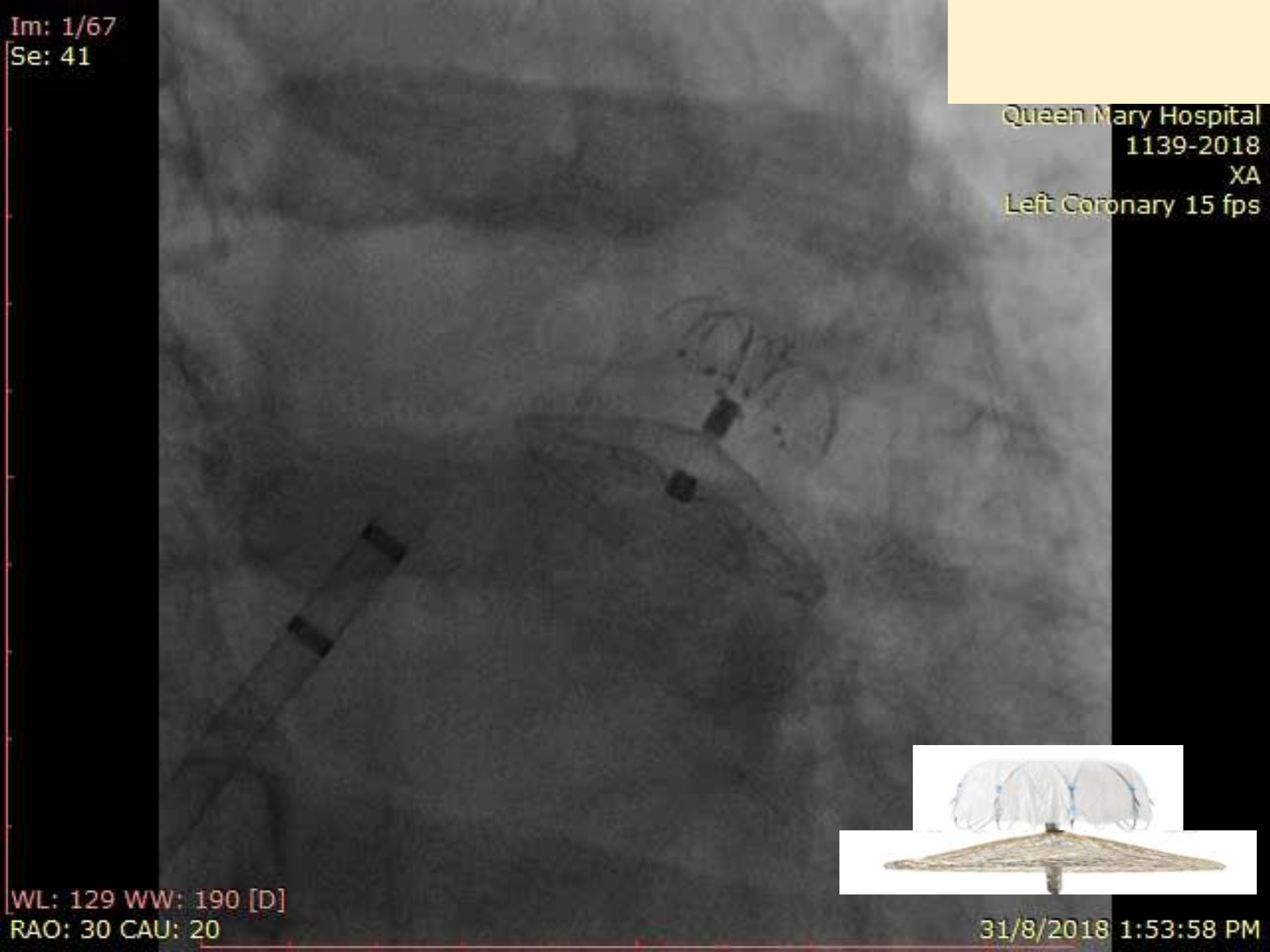
Deployment of Umbrella/Lobe





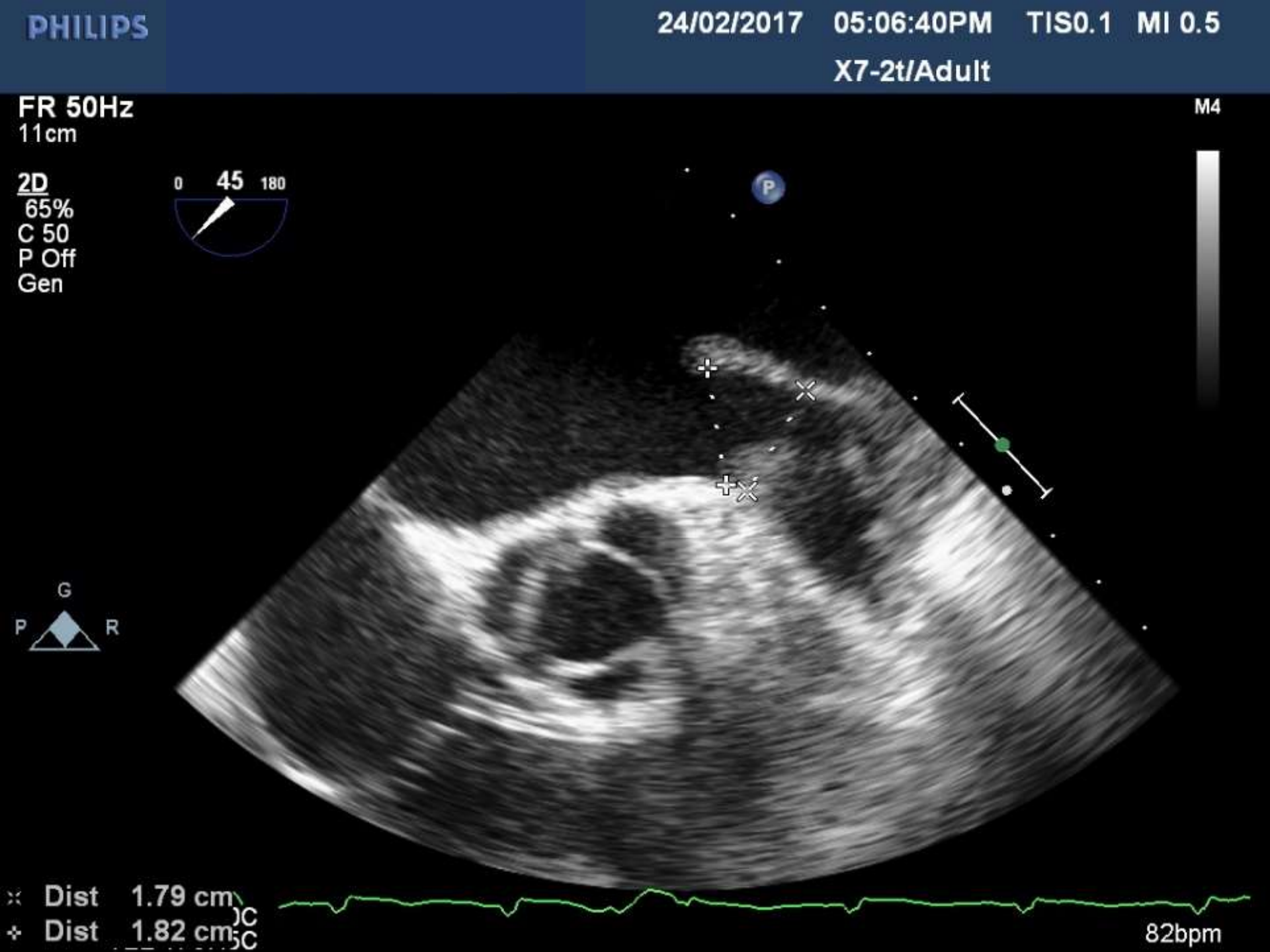
Im: 1/47
Se: 31
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
31/8/2018 1:47:24 PM

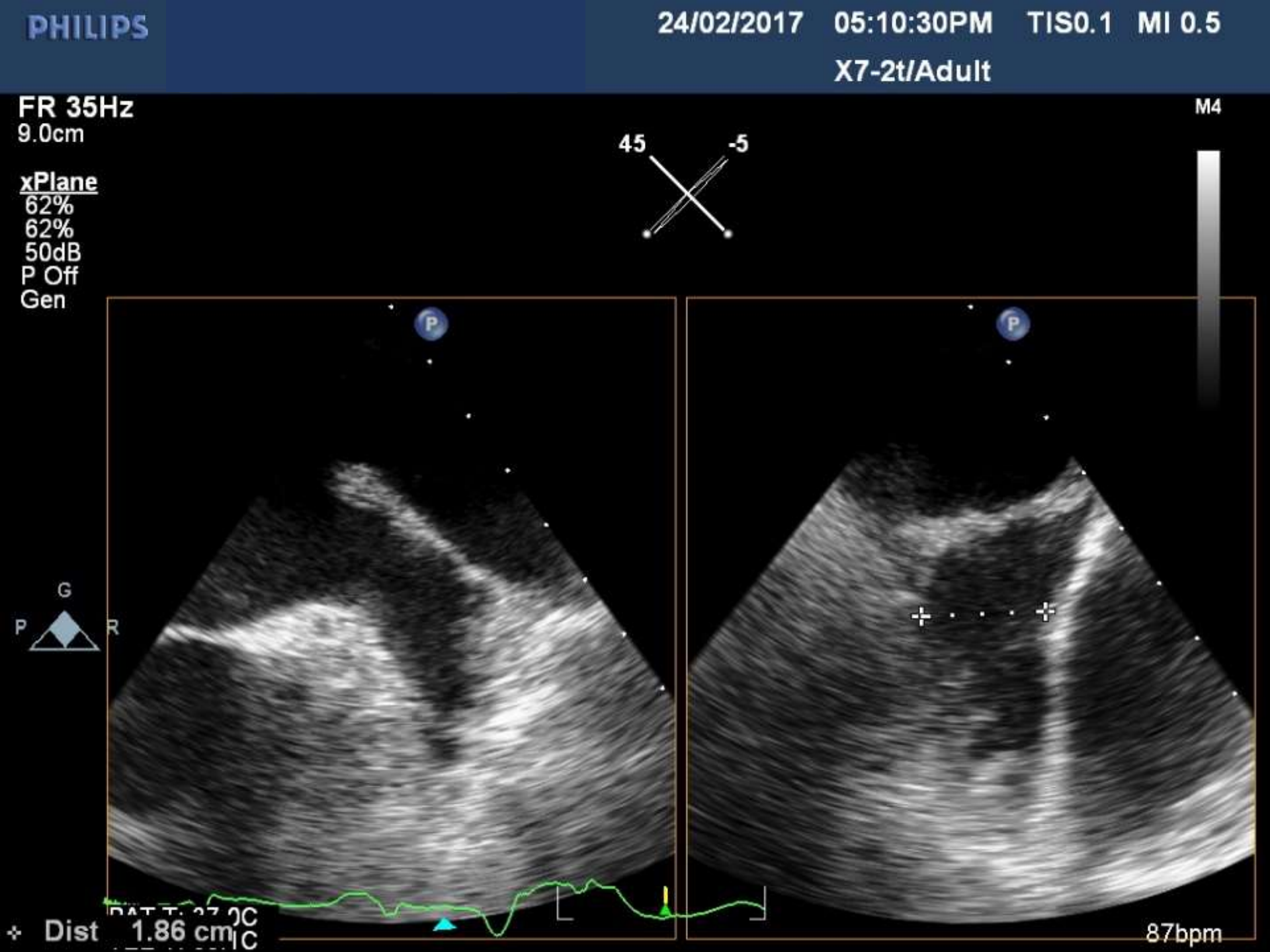

PHILIPS
31/08/2018 13:51:40 TIS0.3 MI 0.6
X7-2t/Adult
FR 50Hz
13cm
2D
72%
C 50
P Off
HGen
M4
JPEG
77 bpm
PAT T: 37.0C
TEE T: 39.2C
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 40 CRA: 20
31/8/2018 1:50:06 PM

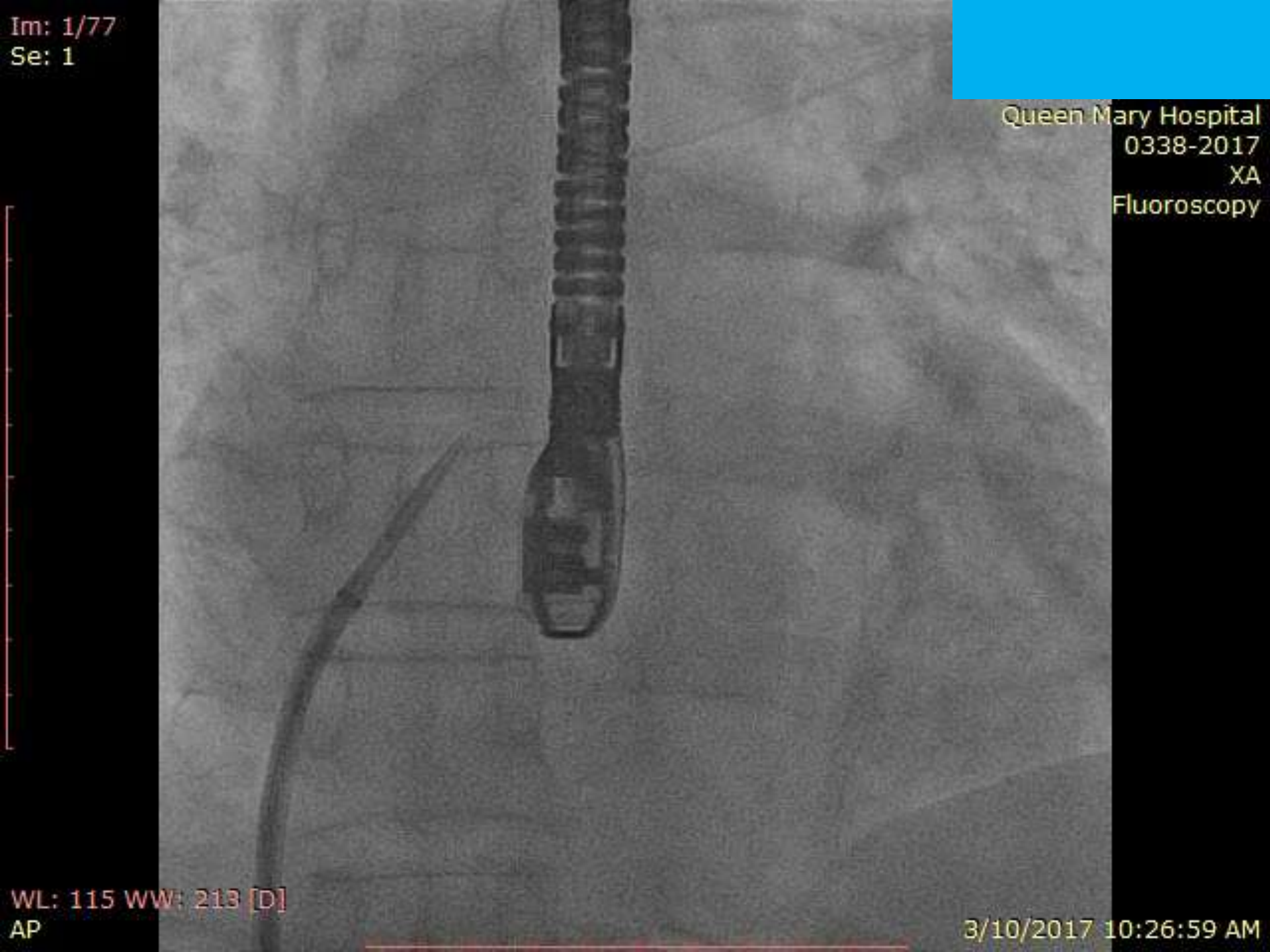

Im: 1/67
Se: 41
Queen Mary Hospital
1139-2018
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
31/8/2018 1:53:58 PM

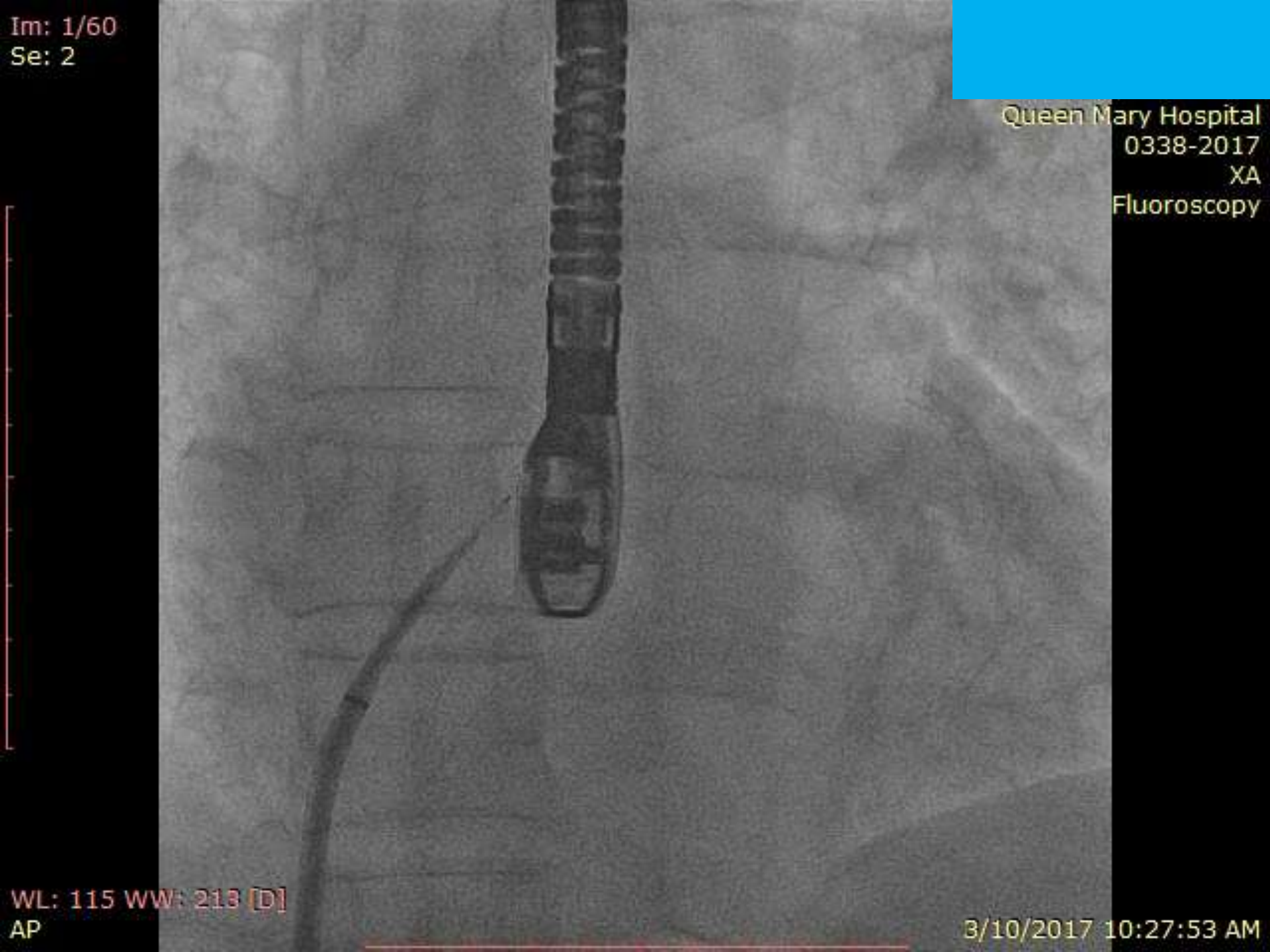
W1

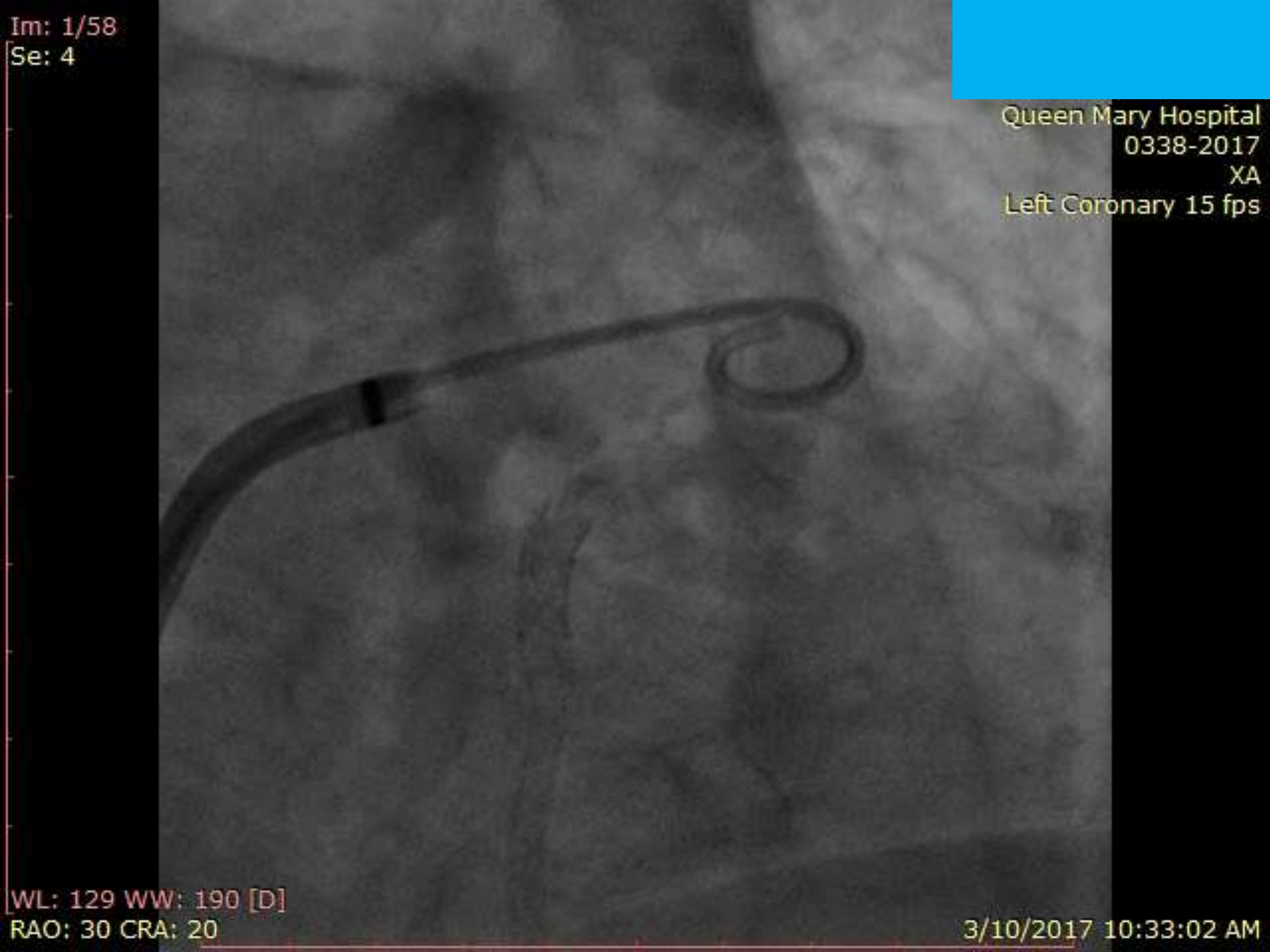
HKU Med

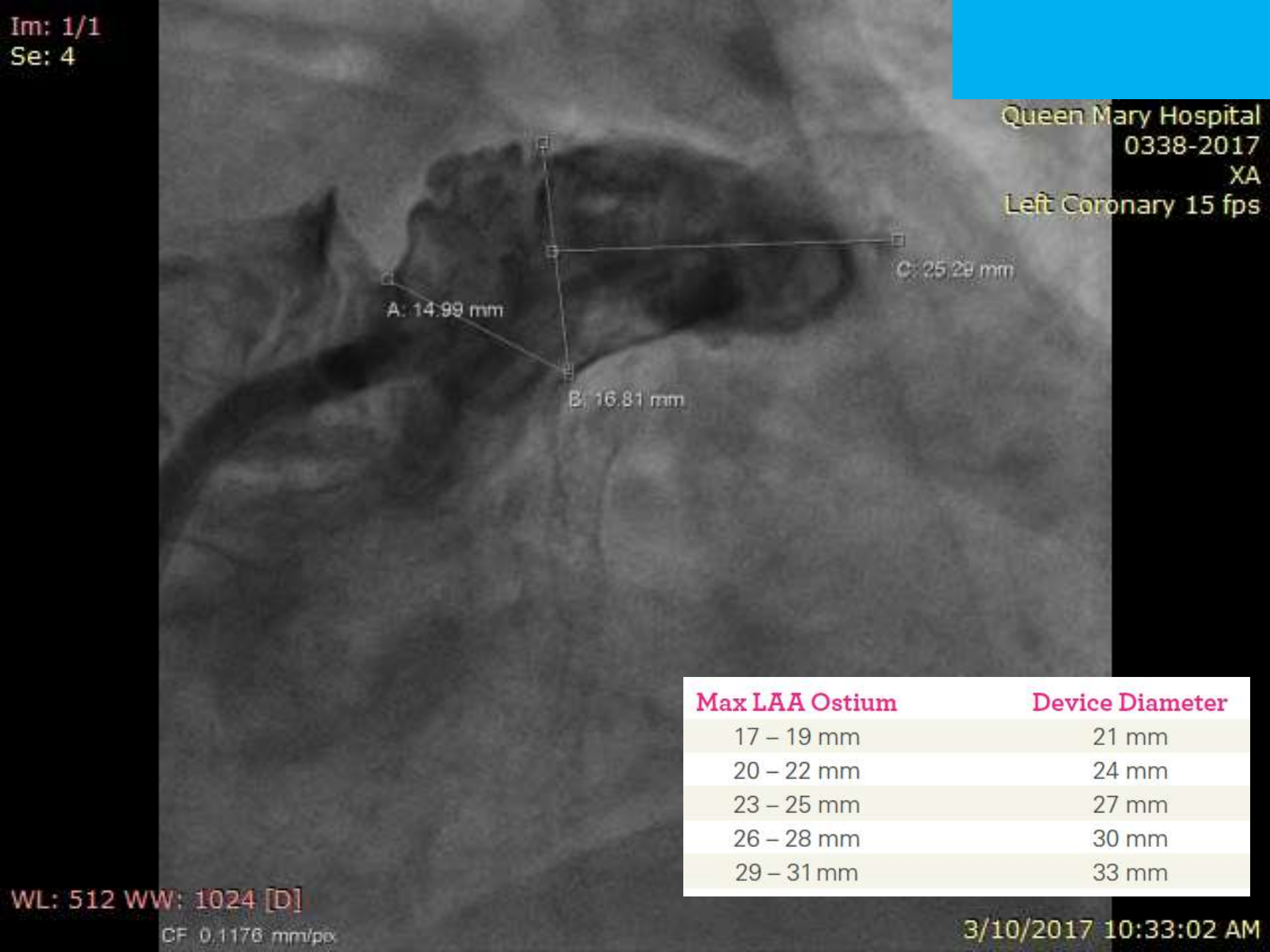

PHILIPS
24/02/2017 05:06:40PM TIS0.1 MI 0.5
X7-2t/Adult
FR 50Hz
11cm
M4
2D
65%
C 50
P Off
Gen
0 45 180
G
P R
Dist 1.79 cm
Dist 1.82 cm
82bpm


PHILIPS
24/02/2017 05:10:30PM TIS0.1 MI 0.5
X7-2t/Adult
FR 35Hz
9.0cm
xPlane
62%
62%
50dB
P Off
Gen
45
-5
M4
G
P
R
Dist 1.86 cm
87bpm

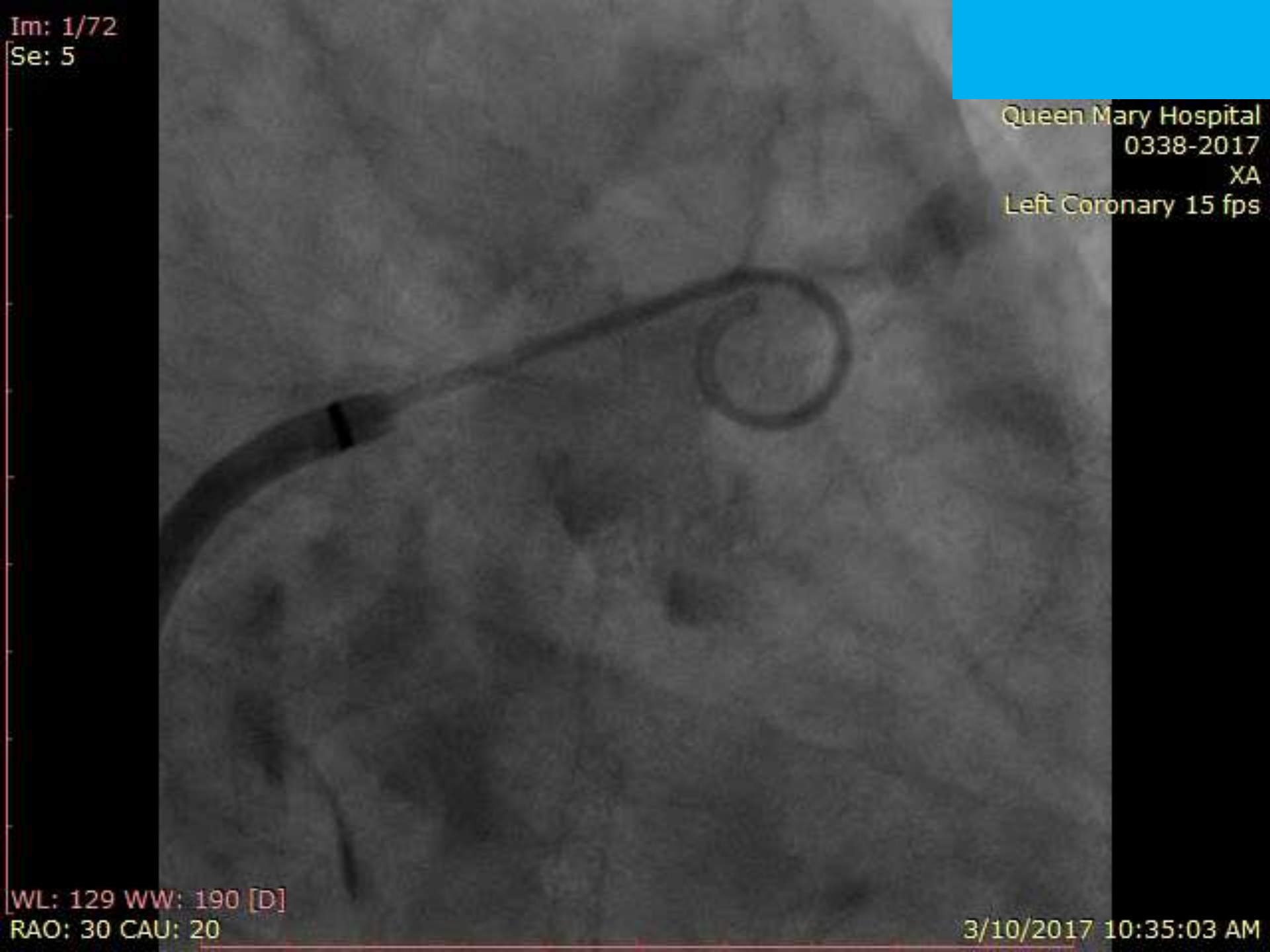

Im: 1/77
Se: 1
Queen Mary Hospital
0338-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
AP
3/10/2017 10:26:59 AM

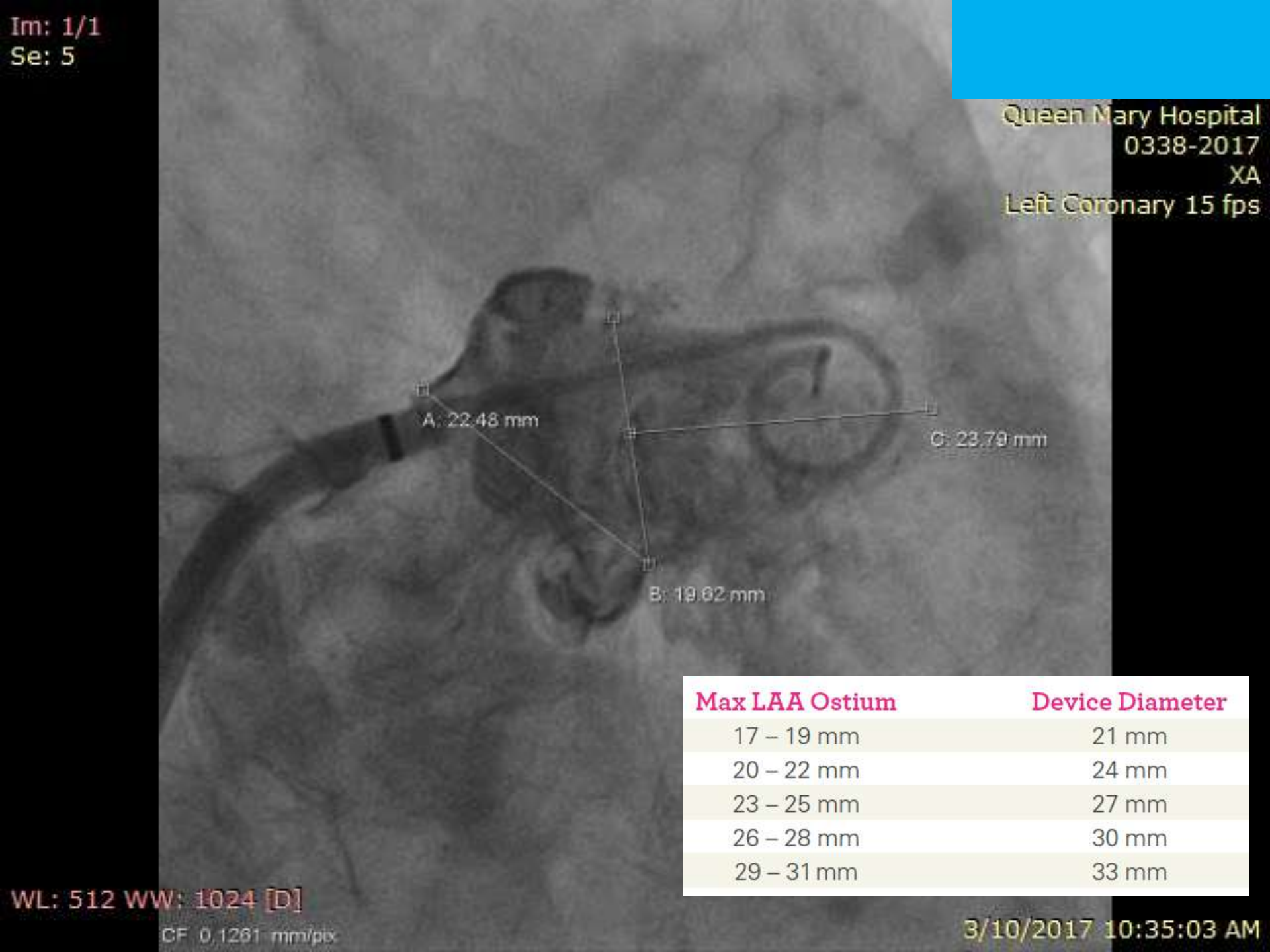

Im: 1/60
Se: 2
Queen Mary Hospital
0338-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
AP
3/10/2017 10:27:53 AM


Im: 1/58
Se: 4
Queen Mary Hospital
0338-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CRA: 20
3/10/2017 10:33:02 AM

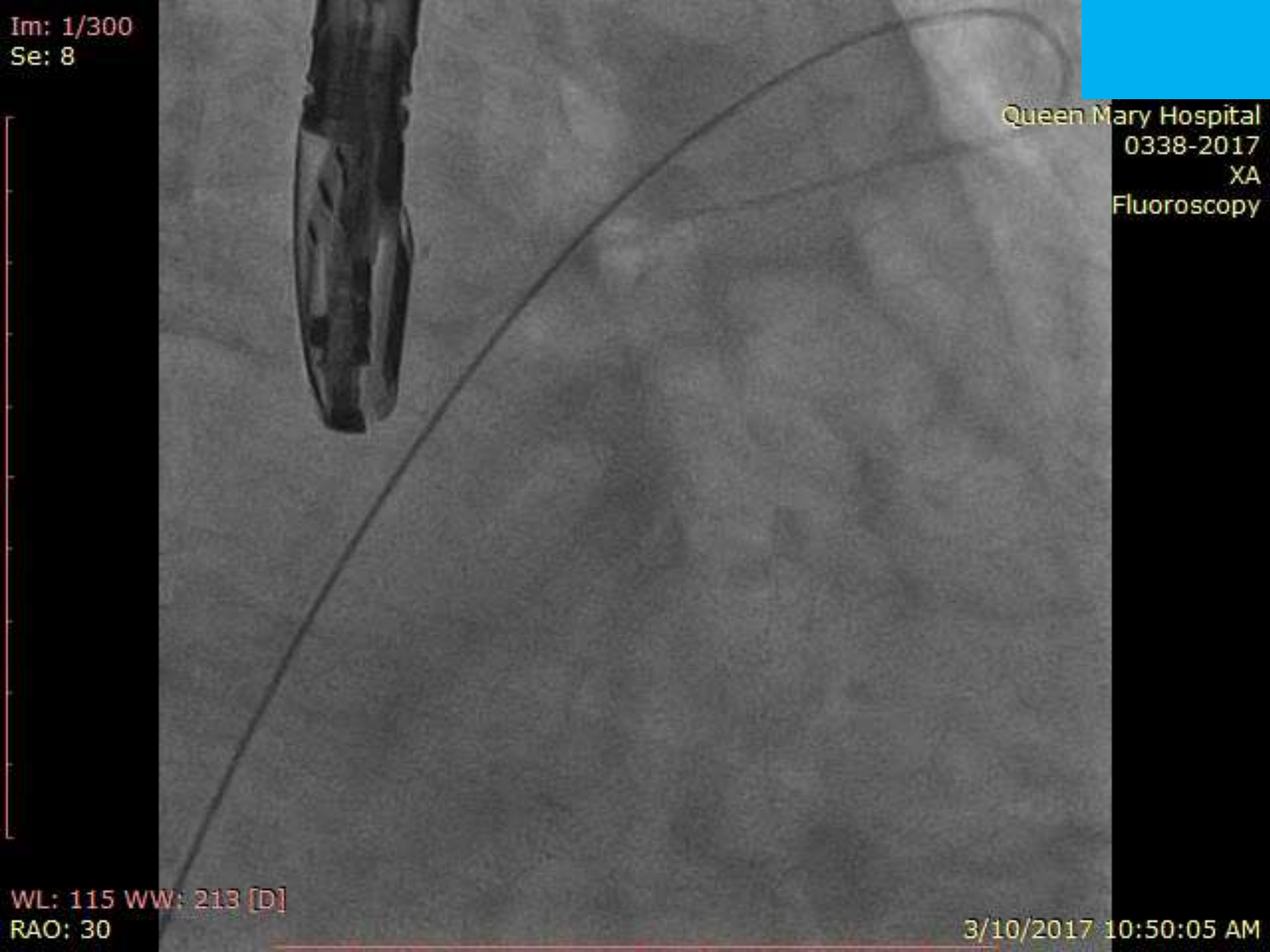


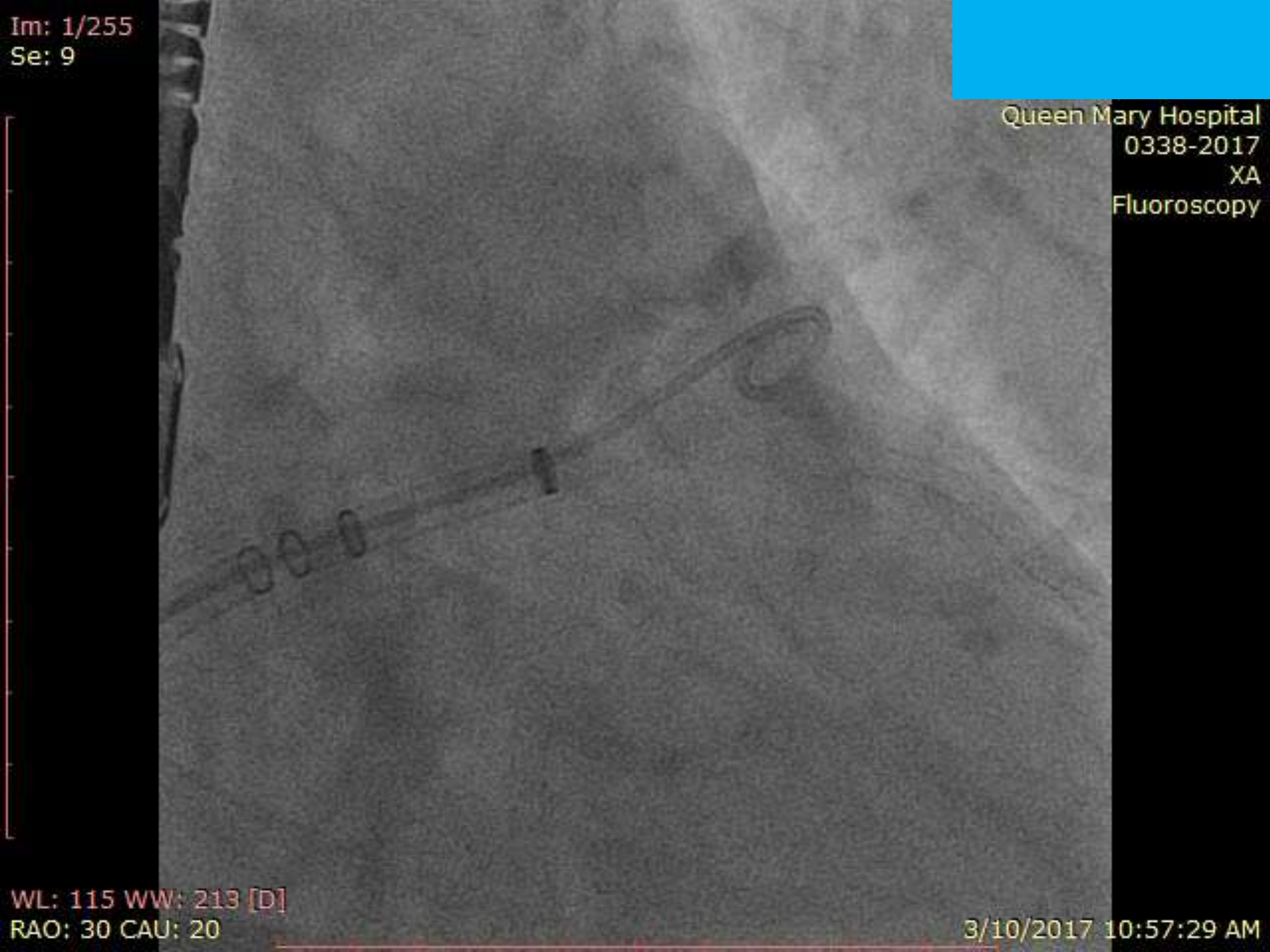
Max LAA Ostium	Device Diameter
17 – 19 mm	21 mm
20 – 22 mm	24 mm
23 – 25 mm	27 mm
26 – 28 mm	30 mm
29 – 31 mm	33 mm


Im: 1/72
Se: 5
Queen Mary Hospital
0338-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
3/10/2017 10:35:03 AM

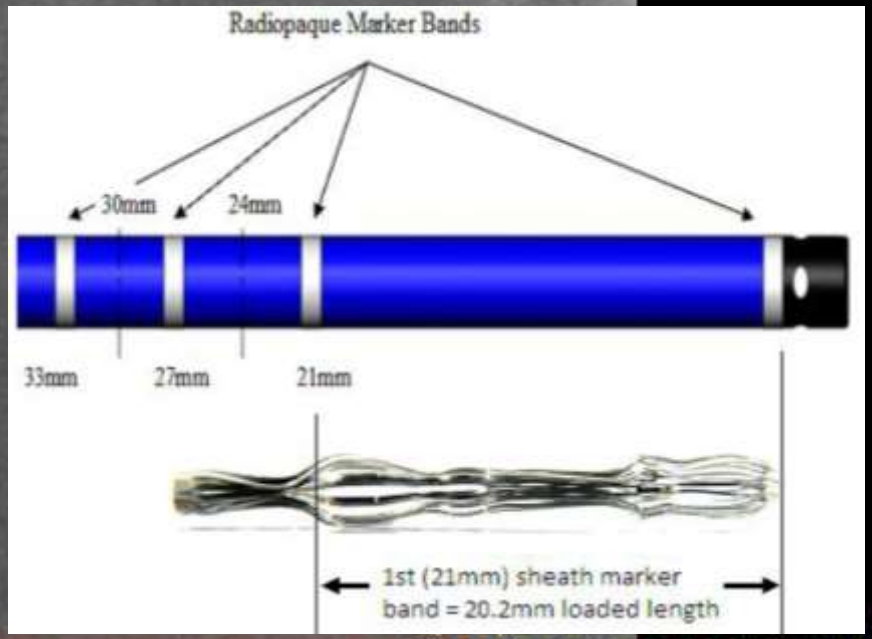


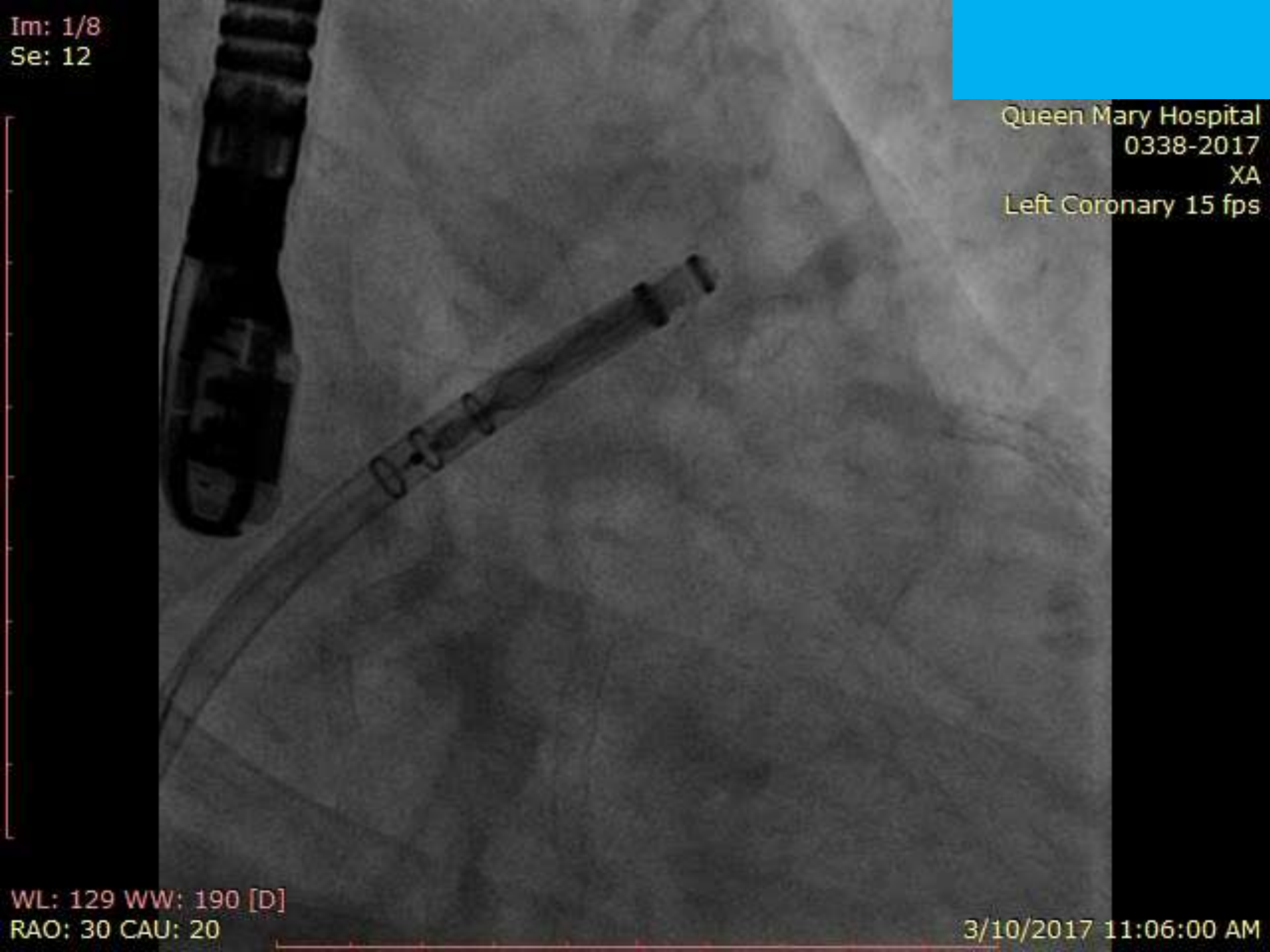
Max LAA Ostium	Device Diameter
17 – 19 mm	21 mm
20 – 22 mm	24 mm
23 – 25 mm	27 mm
26 – 28 mm	30 mm
29 – 31 mm	33 mm

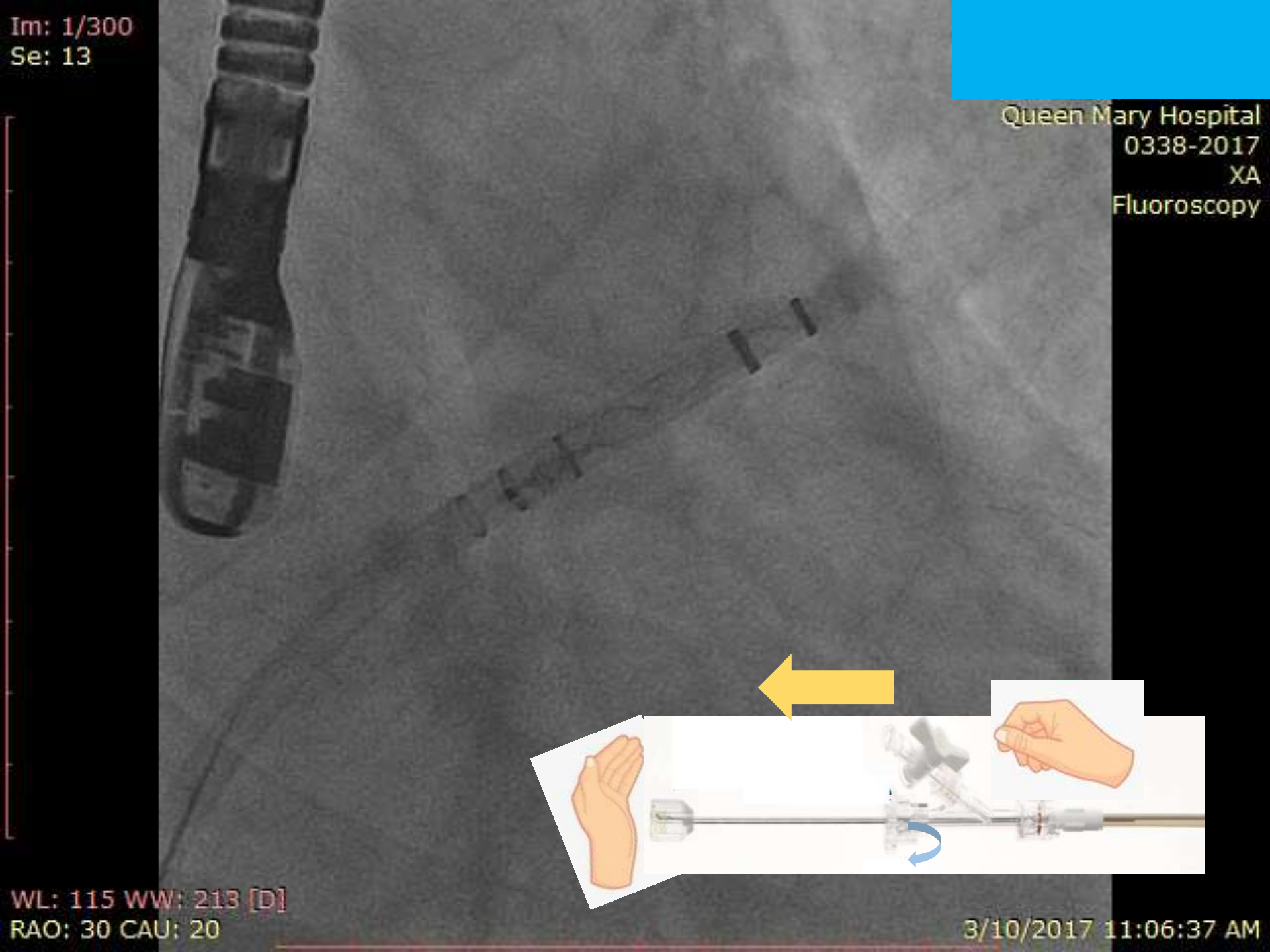

Im: 1/300
Se: 8
Queen Mary Hospital
0338-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
RAO: 30
3/10/2017 10:50:05 AM

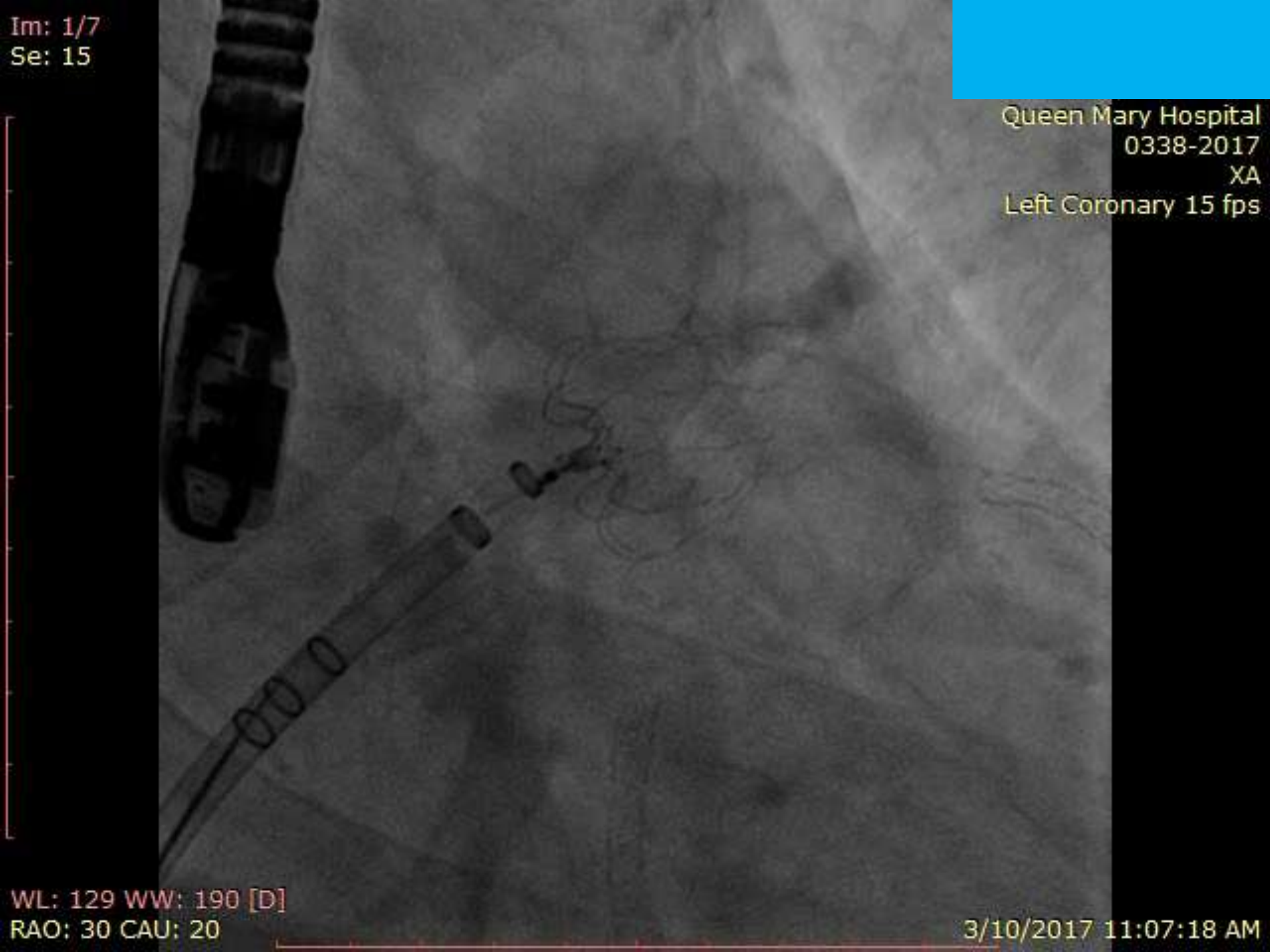

Im: 1/255
Se: 9
Queen Mary Hospital
0338-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
RAO: 30 CAU: 20
3/10/2017 10:57:29 AM

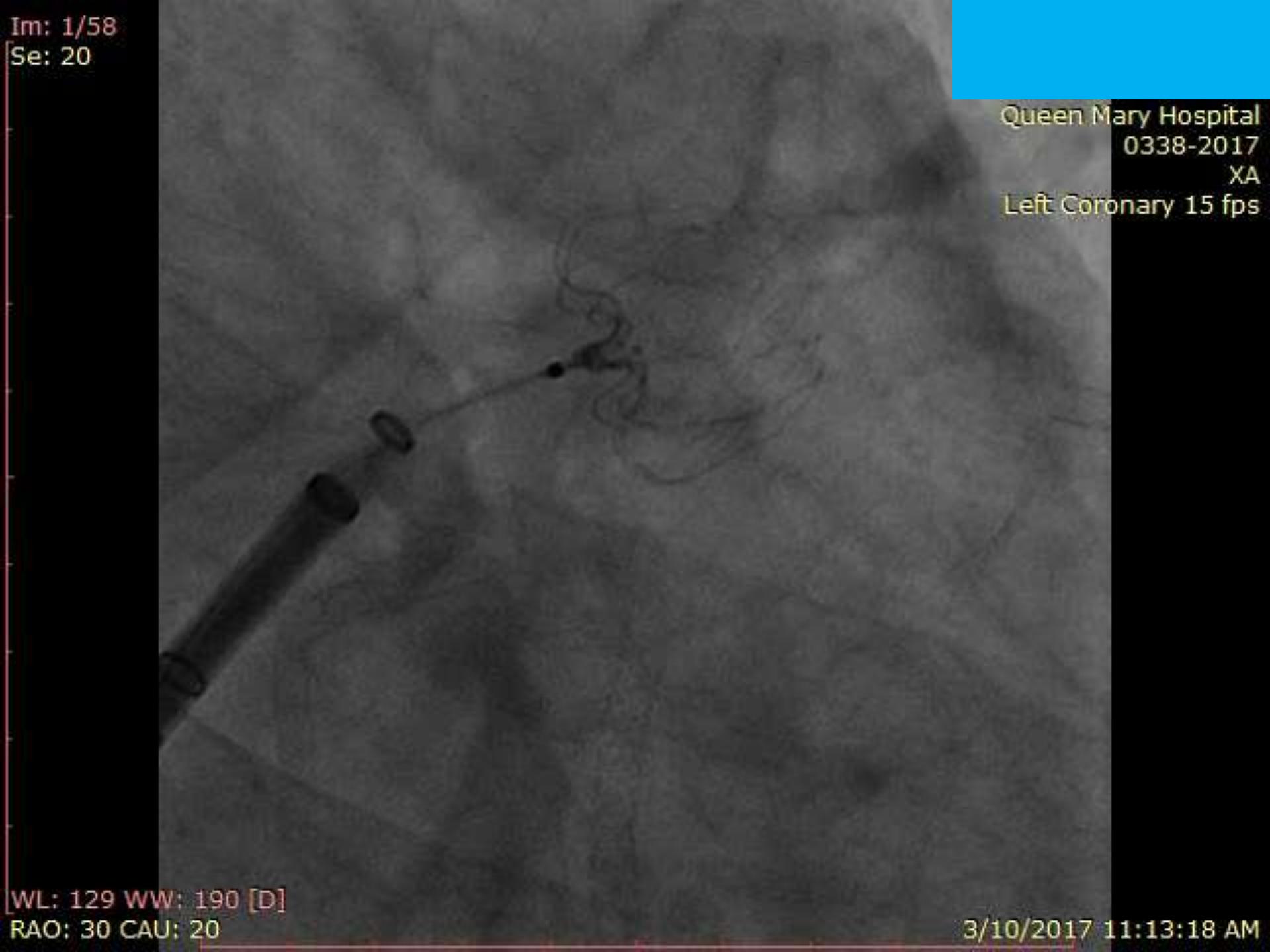
Im: 1/300
Se: 10
Queen Mary Hospital
0338-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
RAO: 30 CAU: 20

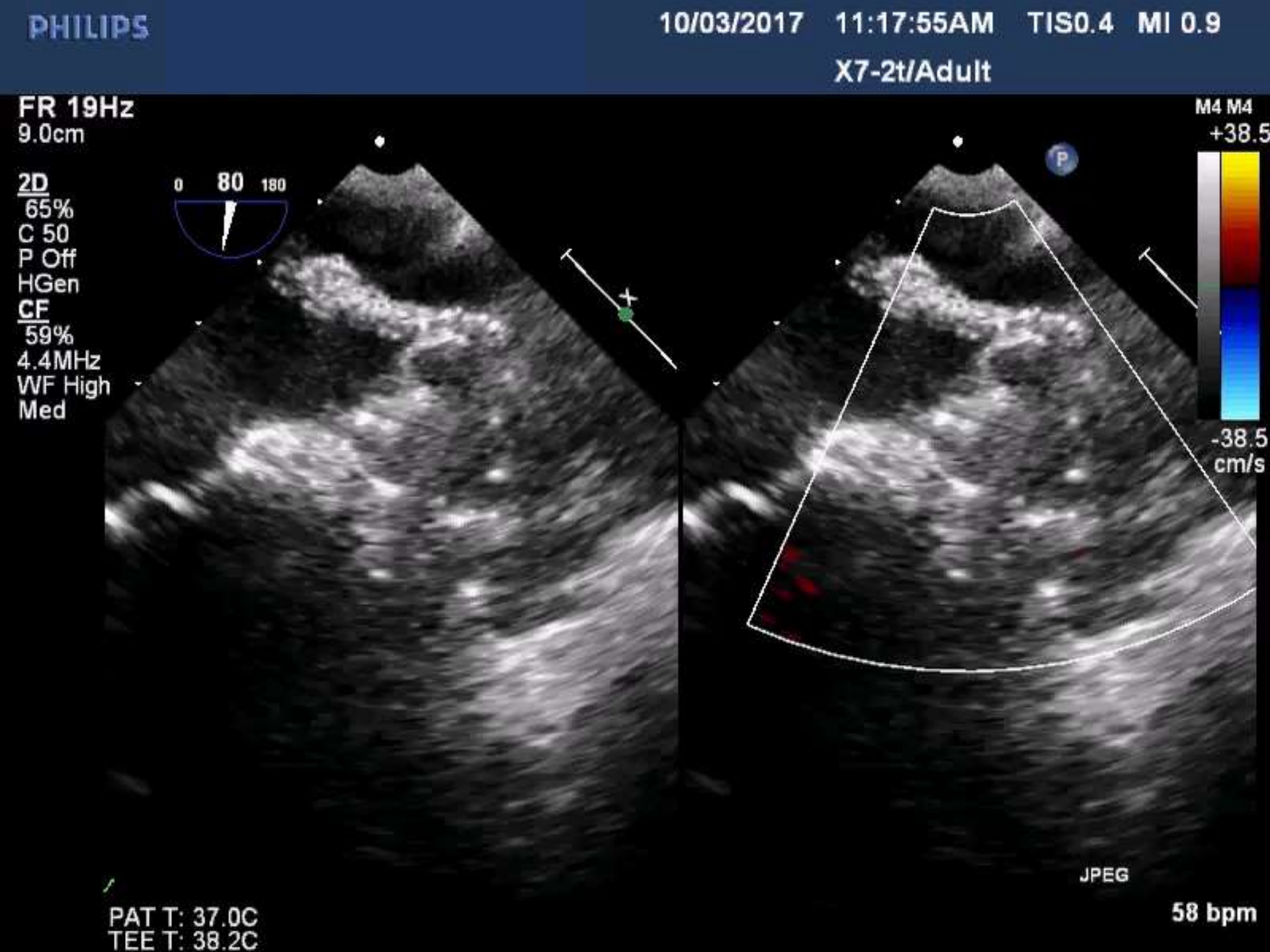

Radiopaque Marker Bands
30mm
24mm
33mm
27mm
21mm
1st (21mm) sheath marker
band = 20.2mm loaded length


Im: 1/8
Se: 12
Queen Mary Hospital
0338-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
3/10/2017 11:06:00 AM

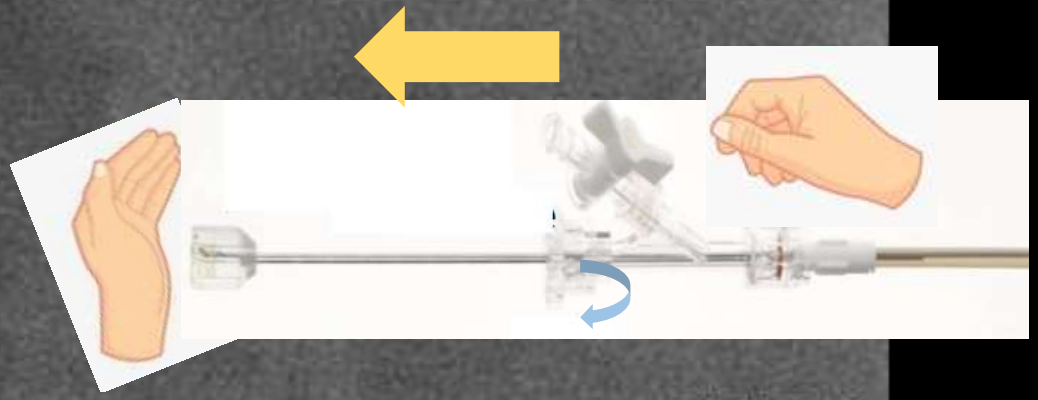

Im: 1/300
Se: 13
Queen Mary Hospital
0338-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
RAO: 30 CAU: 20
3/10/2017 11:06:37 AM


Im: 1/7
Se: 15
Queen Mary Hospital
0338-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
3/10/2017 11:07:18 AM


Im: 1/58
Se: 20
Queen Mary Hospital
0338-2017
XA
Left Coronary 15 fps
WL: 129 WW: 190 [D]
RAO: 30 CAU: 20
3/10/2017 11:13:18 AM


PHILIPS
10/03/2017 11:17:55AM TIS0.4 MI 0.9
X7-2t/Adult
FR 19Hz
9.0cm
2D
65%
C 50
P Off
HGen
CF
59%
4.4MHz
WF High
Med
0 80 180
M4 M4
+38.5
-38.5
cm/s
JPEG
PAT T: 37.0C
TEE T: 38.2C
58 bpm

Im: 1/248
Se: 23
Queen Mary Hospital
0338-2017
XA
Fluoroscopy
WL: 115 WW: 213 [D]
RAO: 30 CAU: 20
3/10/2017 11:15:41 AM



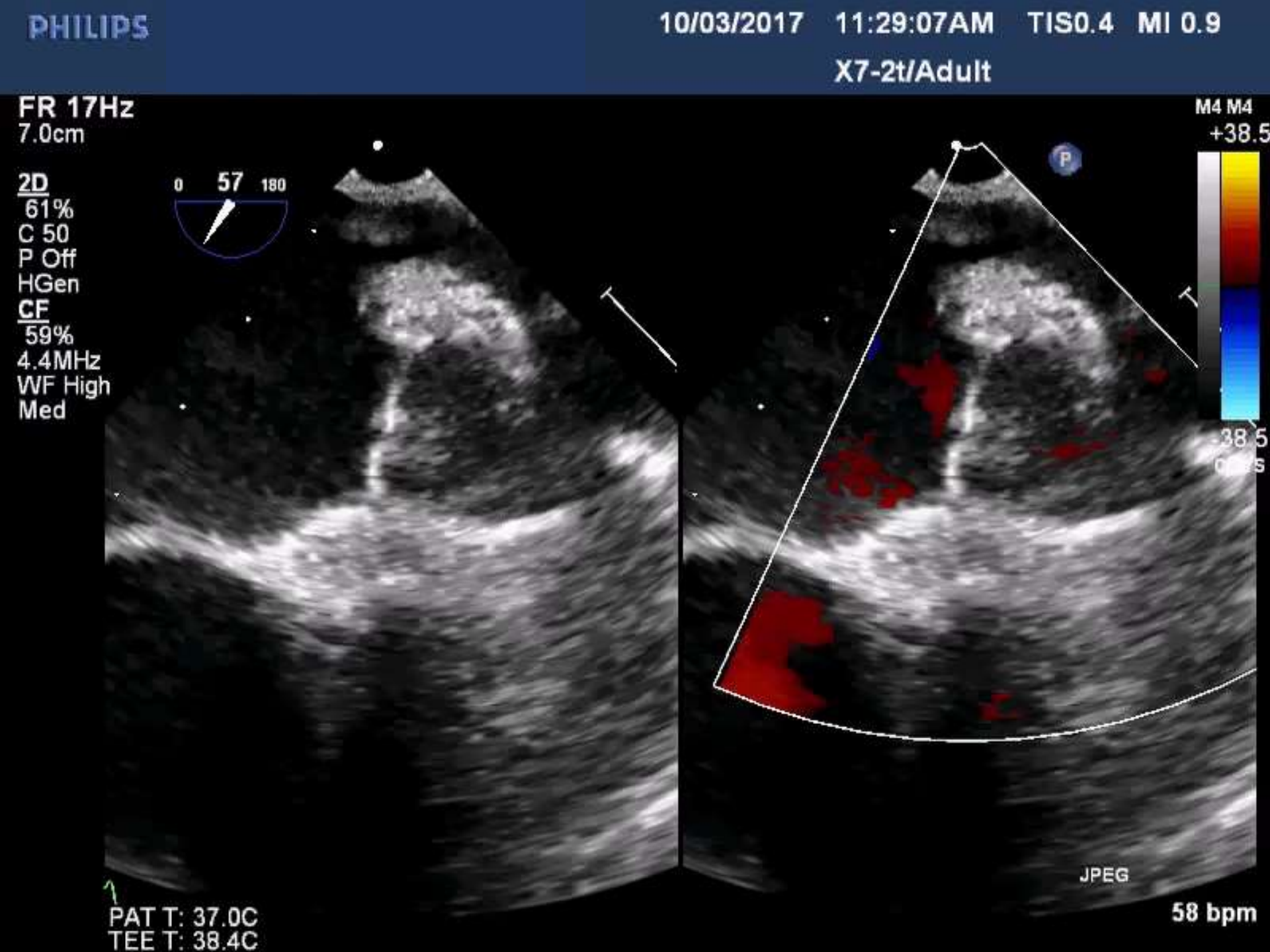
Im: 1/56
Se: 25

Queen Mary Hospital
0338-2017
XA
Left Coronary 15 fps

Watchman 24mm

WL: 129 WW: 190 [D]
RAO: 30 CAU: 20

3/10/2017 11:18:35 AM


PHILIPS
10/03/2017 11:29:07AM TIS0.4 MI 0.9
X7-2t/Adult
FR 17Hz
7.0cm
2D
61%
C 50
P Off
HGen
CF
59%
4.4MHz
WF High
Med
0 57 180
M4 M4
+38.5
JPEG
58 bpm
PAT T: 37.0C
TEE T: 38.4C

Device Release Criteria

All criteria must be met prior to device release (PASS)

Position – device is distal to or at the ostium of the LAA

Anchor – fixation anchors engaged / device is stable

Size – device is compressed 8-20% of original size

Seal – device spans ostium, all lobes of LAA are covered

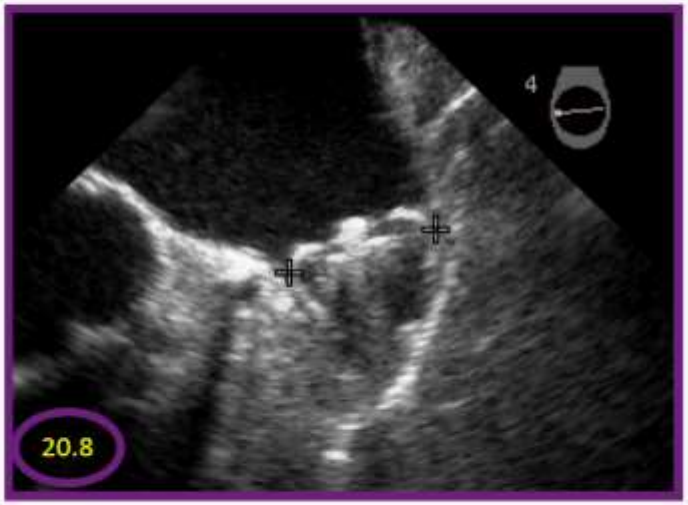
– If necessary, device can be recaptured (partial or full)

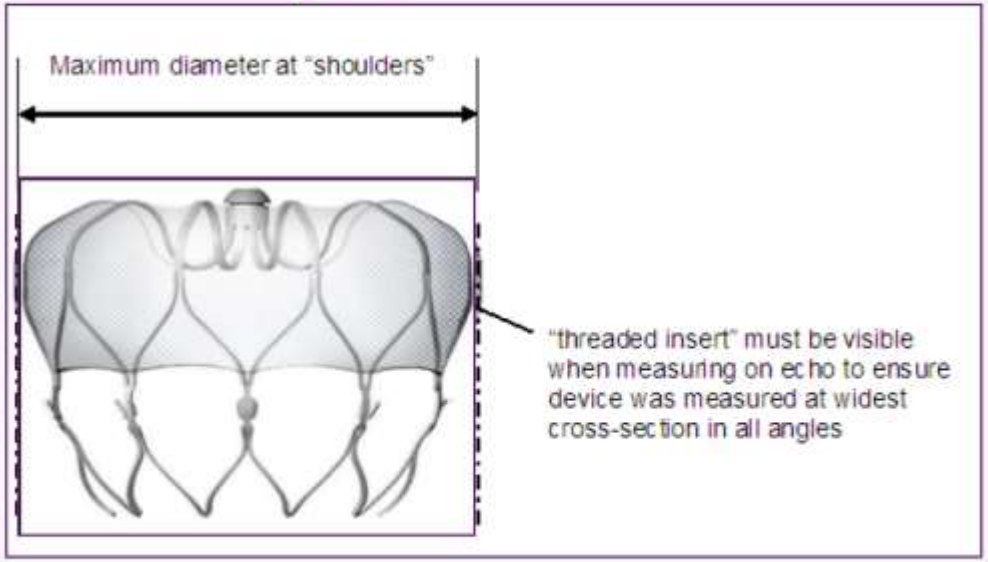
Device Release Criteria – Size

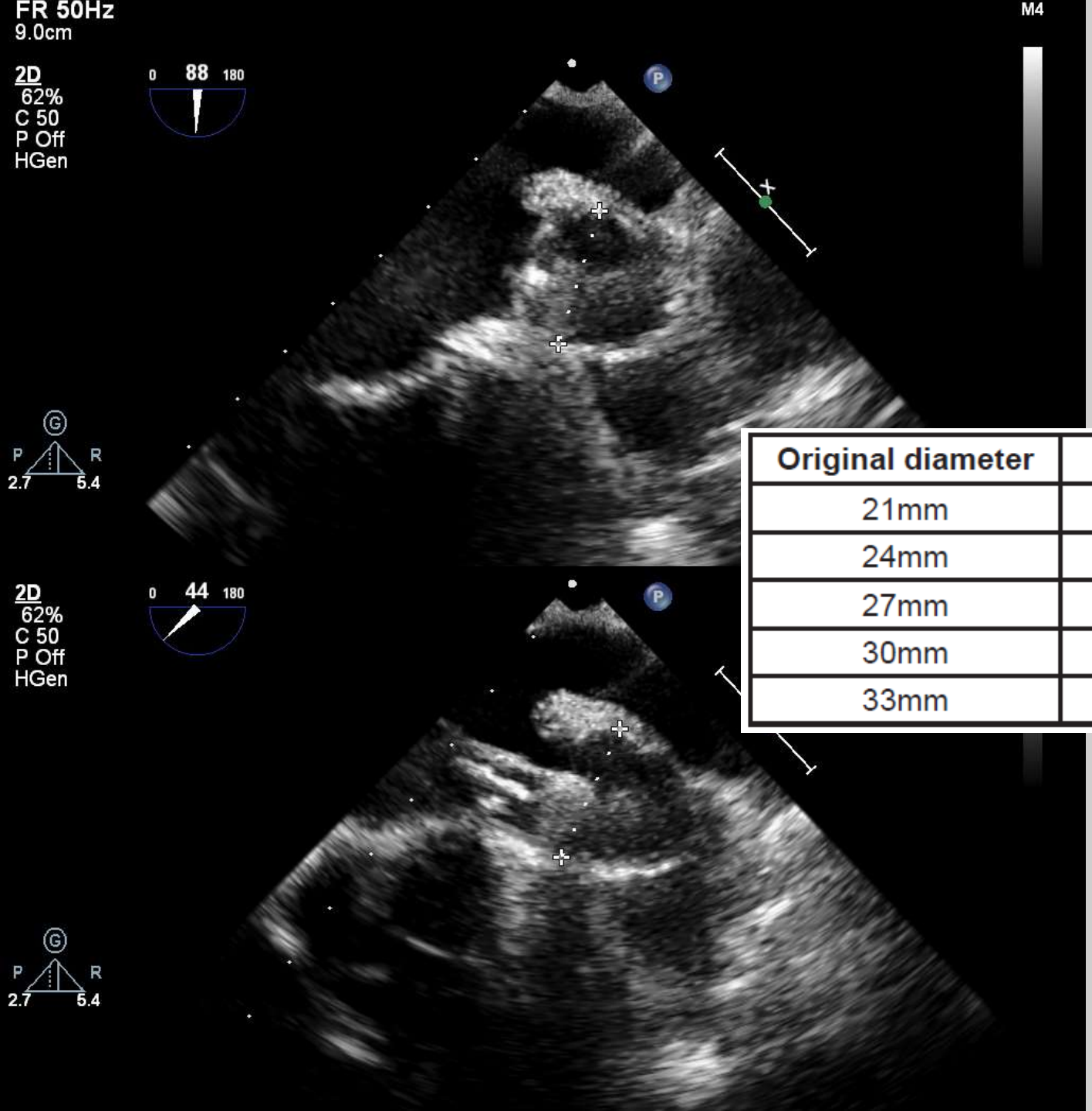
Compression

Device Size *(uncompressed diameter)*	**Maximum (20%)** Compression Measured Diameter*	**Minimum (8%)** Compression Measured Diameter*
21	16.8 mm	19.3 mm
24	19.2 mm	22.1 mm
27	21.6 mm	24.8 mm
30	24.0 mm	27.6 mm
33	26.4 mm	30.4 mm

Measure in-situ device diameter at approximate TEE angles of 0, 45, 90 and 135 degrees to accurately assess device compression







Original diameter	Compressed diameter
21mm	16.8 to 19.3mm
24mm	19.2 to 22.1mm
27mm	21.6 to 24.8mm
30mm	24.0 to 27.6mm
33mm	26.4 to 30.4mm

Watchman 24mm

Watchman 24mm

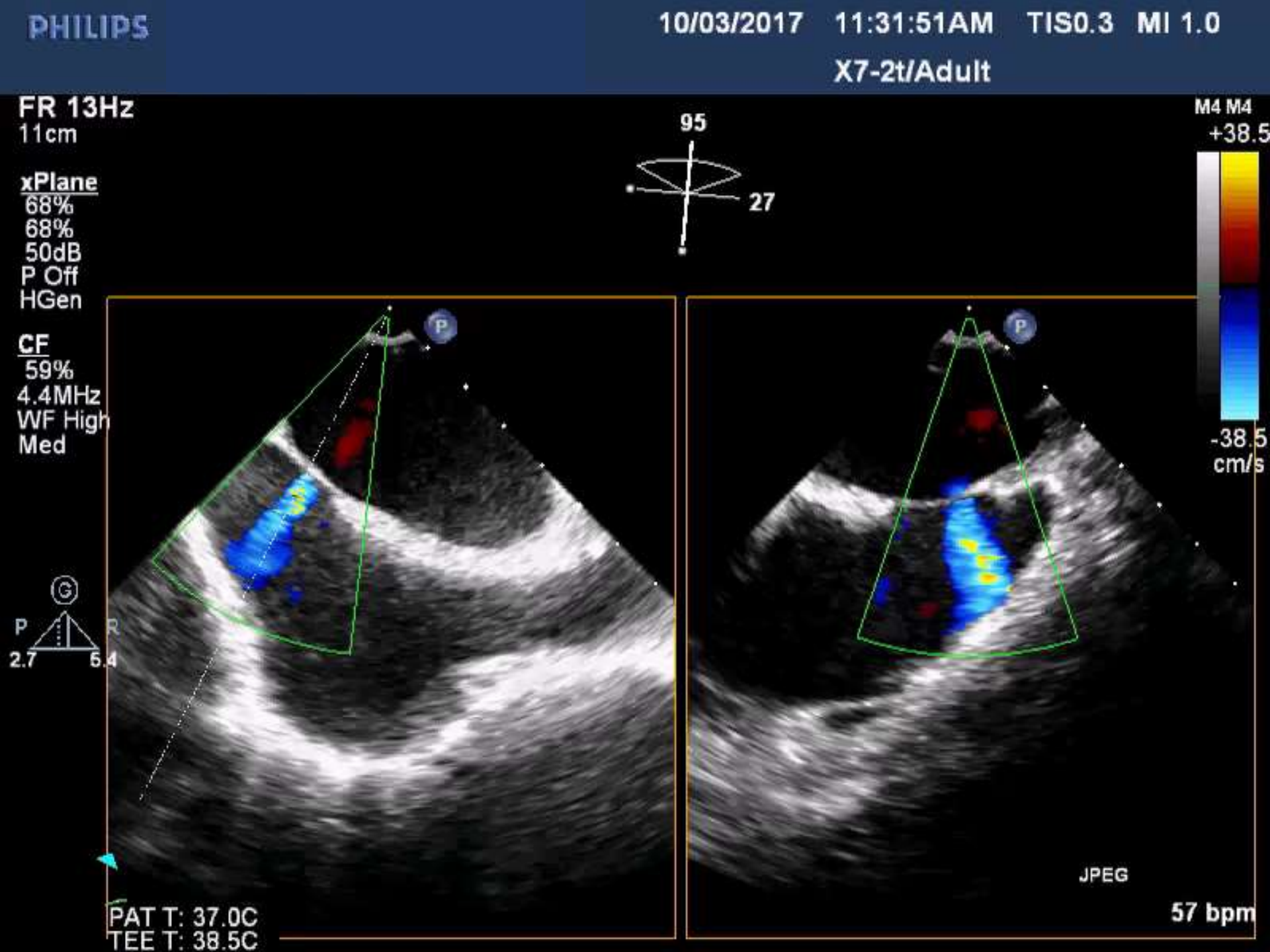
Im: 1/57
Se: 28

Queen Mary Hospital
0338-2017
XA
Left Coronary 15 fps

Watchman 24mm

WL: 129 WW: 190 [D]
RAO: 30 CAU: 20

3/10/2017 11:22:02 AM


PHILIPS
10/03/2017 11:31:51AM TIS0.3 MI 1.0
X7-2t/Adult
FR 13Hz
11cm
xPlane
68%
68%
50dB
P Off
HGen
CF
59%
4.4MHz
WF High
Med
95
27
M4 M4
+38.5
-38.5
cm/s
P
R
2.7
5.4
JPEG
57 bpm
PAT T: 37.0C
TEE T: 38.5C

Conclusion – AMULET/LAMBRE

- AMULET and LAMBRE share some common feature as a 2-compenent device and basic concepts of 2-step deployment
- to allow flexibility for challenging anatomy
- differences in sealing concept and anchoring mechanisms
- familiarity with the specific device design/feature and sizing options is essential for LAA closure outcome optimization

Conclusion – Watchman

- Watchman device – tips
  - Depth of the LAA – TEE/Fluroscopic
  - Delivery sheath relatively more into LAA
  - More forgiving for alignment
  - PASS criteria for release
- Upcoming Watchman FLEX device