

Sea, Sun and cas complexes

Perforations et stents couverts

Frédéric Bouisset et Nicolas Boudou
Fédération des services de Cardiologie
CHU Rangueil, Toulouse



Conflit d'intérêt : aucun

Incidence et facteurs prédictifs

Author	No. of cases	Period of study	Incidence	Grade II and above (incidence [%])	Mortality	Risk factors for perforation
Friedrich et al 1994 ³	4,196	1986-1991	14 (0.12%)	14 (0.12%)	9.1%	Not tested
Ajluni SC et al 1994 ¹	8,932	1988-1992	35 (0.4%)	27 (0.4%) some may be class I	9%	Over-sizing of device in relation to vessel diameter
Ellis et al 1994 ⁸	12,900	1990-1991	62 (0.5%)	47 (0.4%)	41%	Women, age
Gruberg et al 2000 ¹¹	30,746	1990-1999	88 (0.29%)	Not reported	10%	Women, atheroablative devices
Dippel et al 2001 ²	6,214	1995-1999	36 (0.58%)	36 (0.58%)	11.1%	Atheroablative devices, heart failure
Gunning et al 2002 ⁵	6,245	1995-2001	52 (0.8%)	Not reported	11.5%	Not tested
Fasseas et al 2004 ⁶	16,298	1990-2001	95 (0.58%)	78 (0.48%)	7.4%	Atheroablative devices, women, type C lesion, CABG
Javaid et al 2006 ⁴	38,559	1996-2005	72 (0.19%)	58 (0.15%)	17%	Not tested
Shimony et al 2009 ⁷	9,568	2001-2008	57 (0.59%)	50 (0.52%)	7%	Age, hypertension, CTO, calcification, CABG, ACS, RCA, femoral approach
Ben-Gal et al 2010 ²⁰	13,466	2004-2008	33 (0.25%)	26 (0.19%)	12%	Not tested

ATC tout venant

Hendry et al, Eurointervention 2012

Incidence et facteurs prédictifs

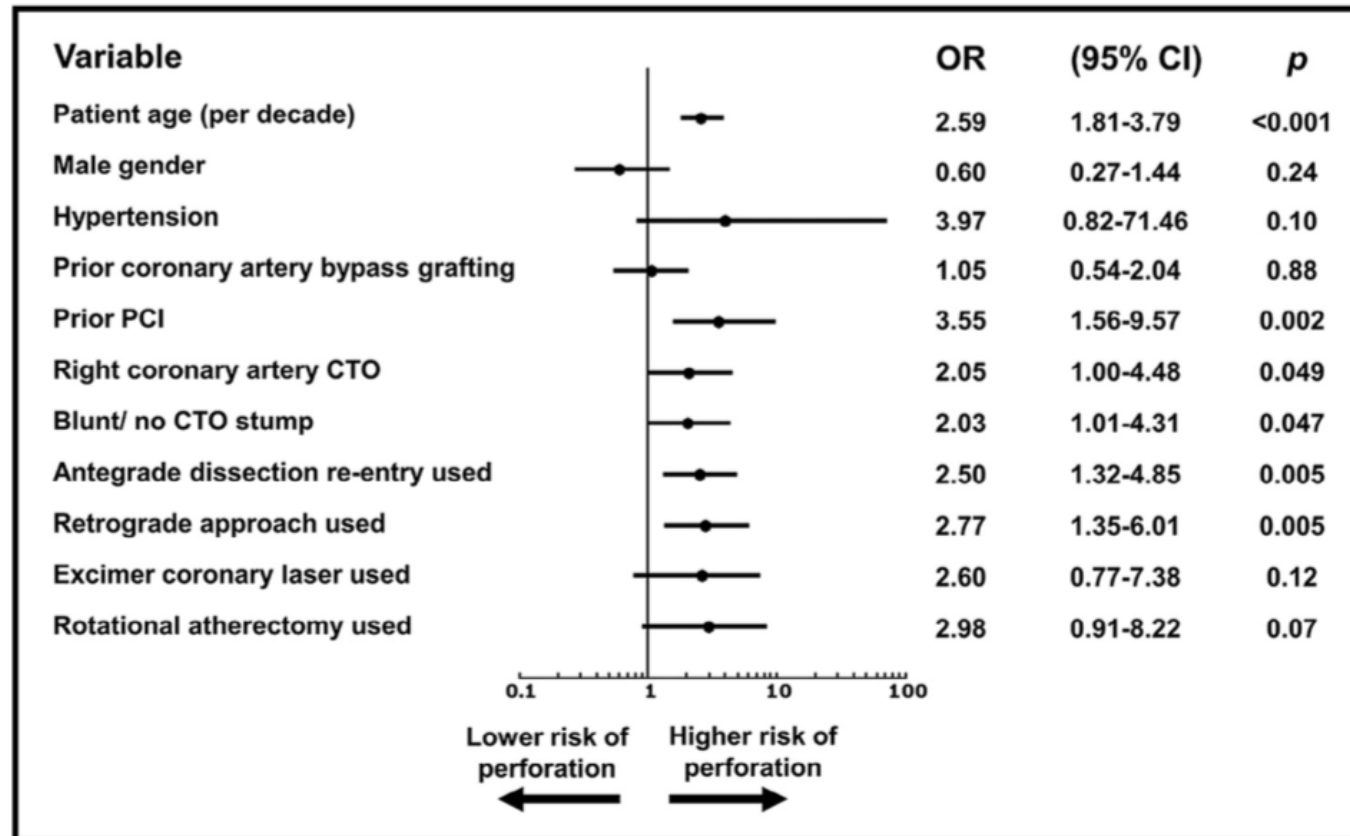
	Perforation	All patients	p-value
Age, mean (SD)	68.59 (8.7)	61.16 (10.8)	<0.001
Females (%)	22 (50%)	2063 (26%)	0.001
Diabetes mellitus (%)	9 (20.45%)	1385 (18%)	0.964
Renal disease (creatinine ≥200 µmol/l)	2 (5.4%)	194 (2.4%)	0.850
Thrombolysis within 24 hrs	6 (13.6%)	446 (5.64%)	0.120
Urgent/emergency procedure	21 (47.7%)	3929 (49.7%)	0.949
Calcification	28 (63.6%)	2329 (29.5%)	0.004
Chronic total occlusion	10 (22%)	510 (6.4%)	<0.001
Proportion treated with DES	33 (75%)	6066 (77%)	0.655
Rotational atherectomy	3 (6.8%)	74 (0.93%)	<0.001
Cutting balloon	5 (11.4%)	90 (1.1%)	<0.001

ATC tout venant

12729 PCI in UK
44 perforations
Incidence : 0.56%

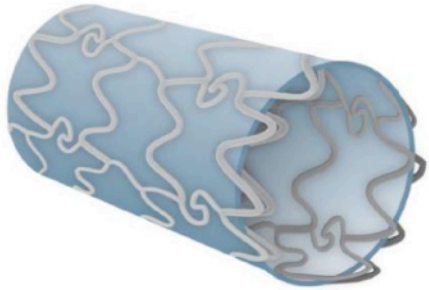
Incidence et facteurs prédictifs

ATC CTO : 3 à 8% selon les séries



2097 CTO PCI
85 perforations
Incidence 4.1%

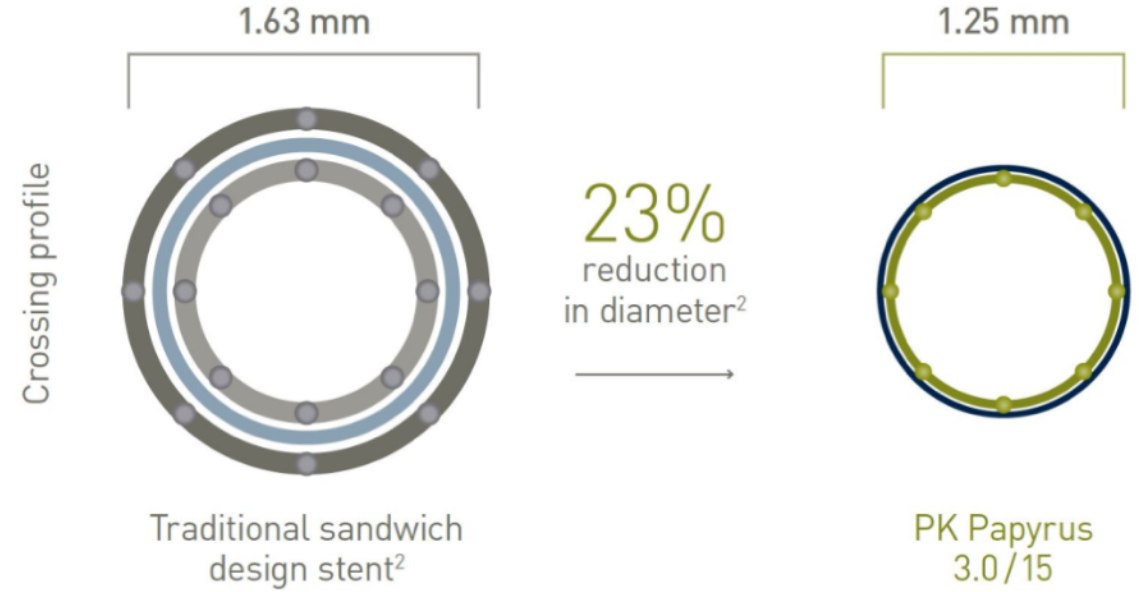
Les stents couverts



Traditional sandwich design stent¹

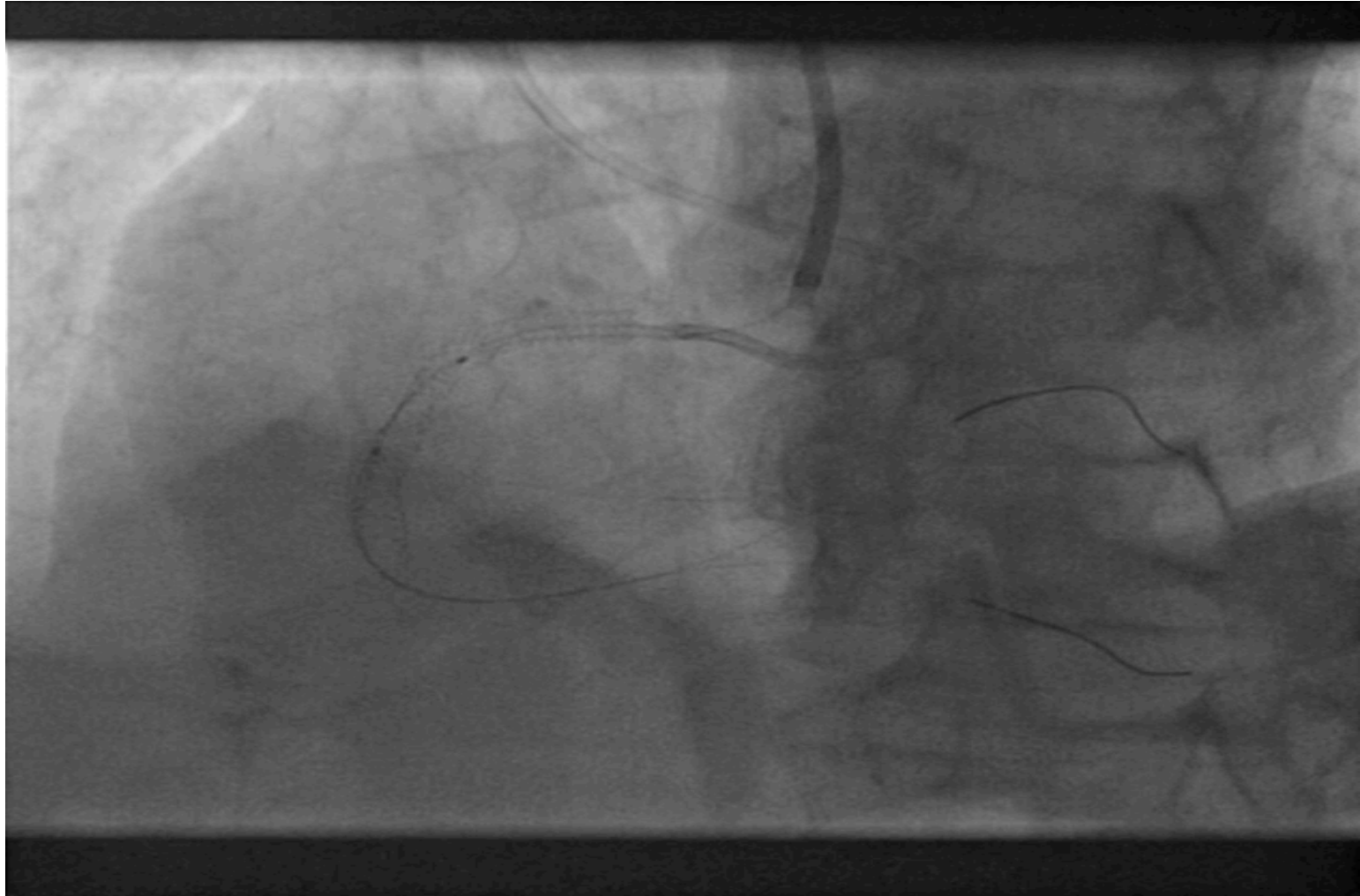


PK Papyrus Covered single stent design

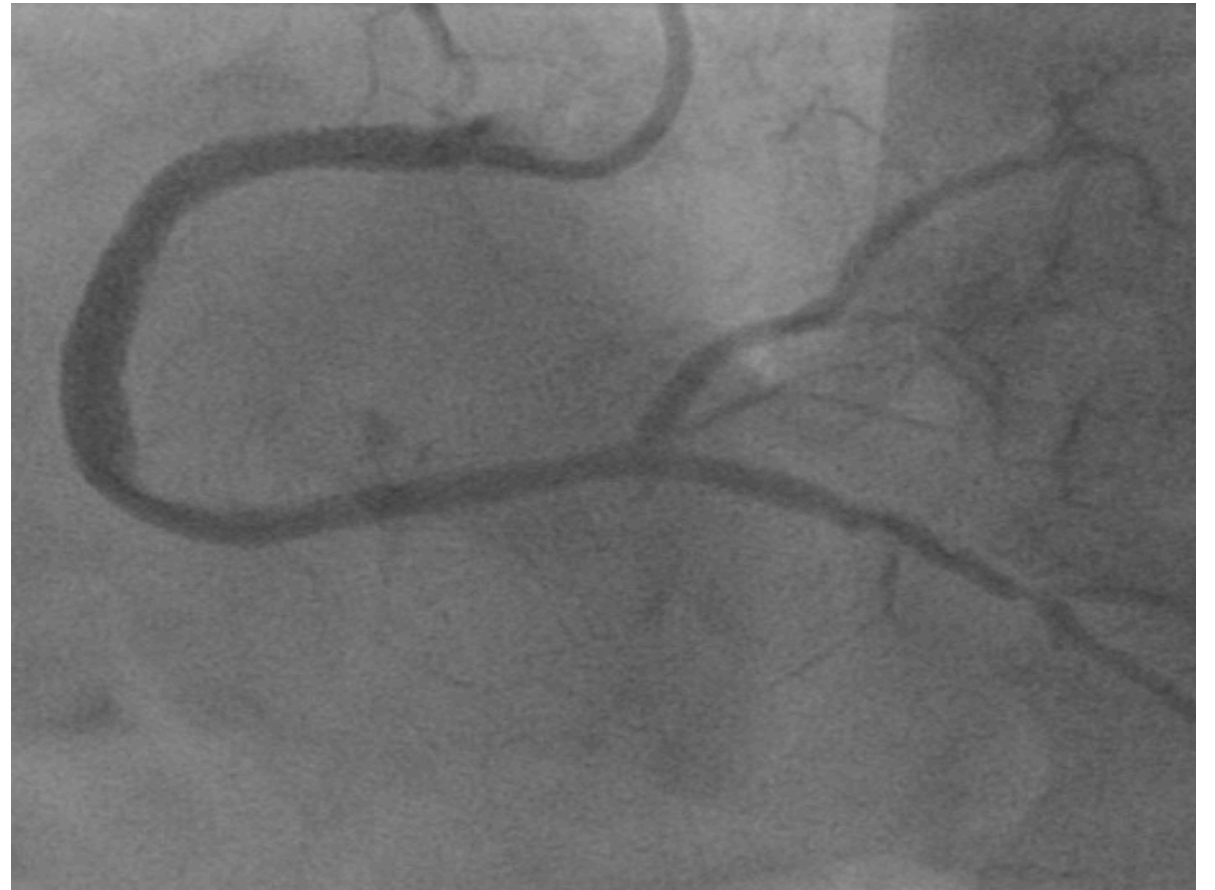


Quelques cas de perforation

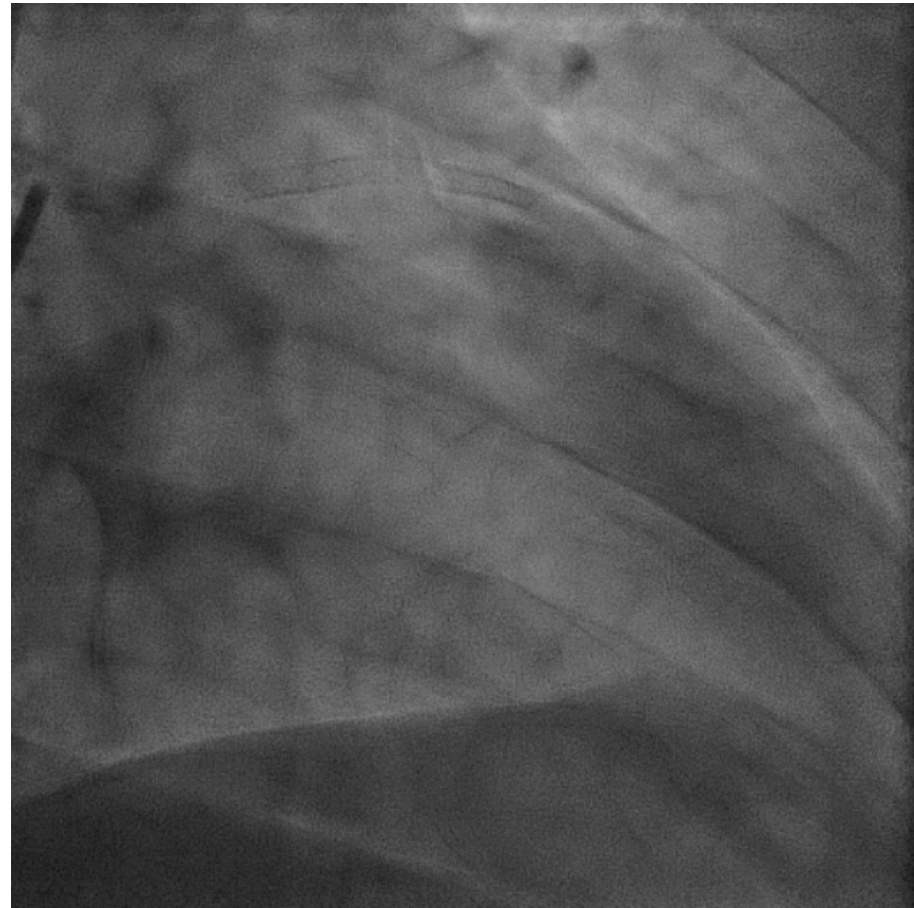
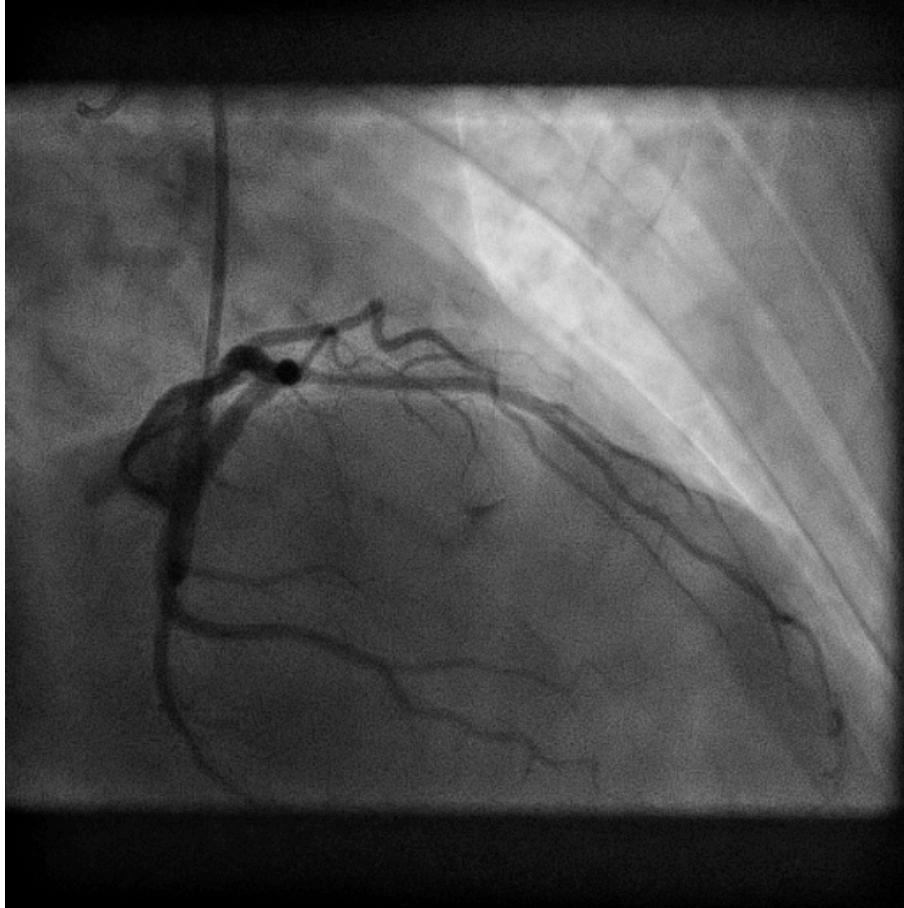
1 – Perforation de la coronaire droite



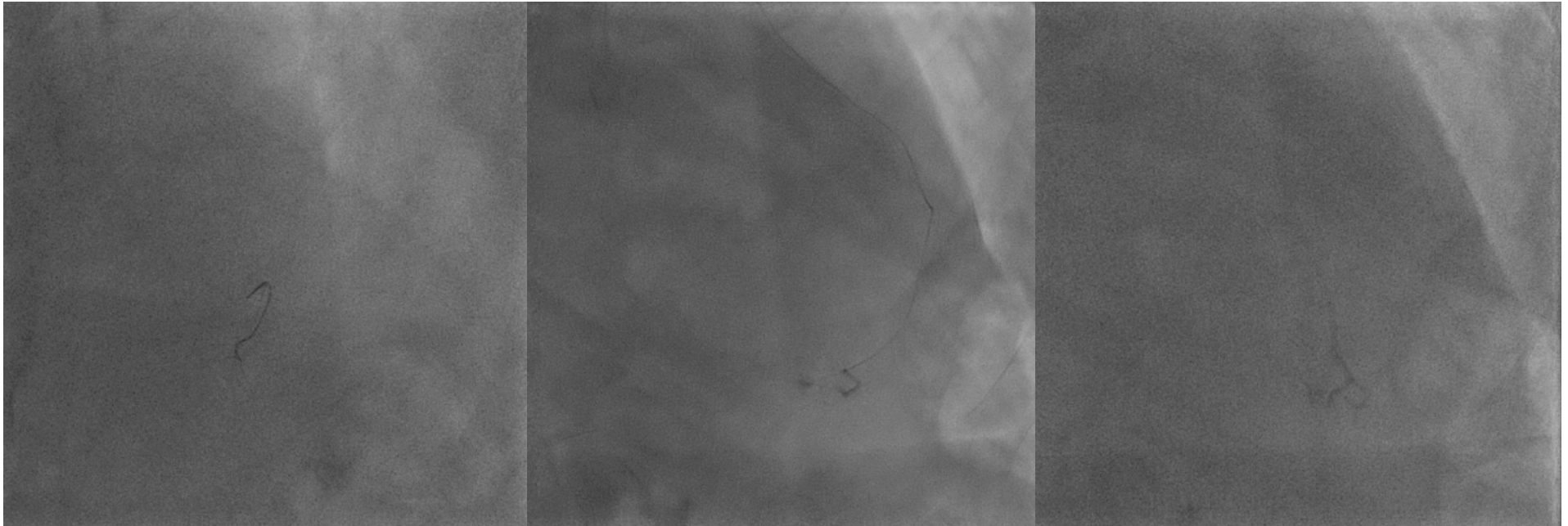
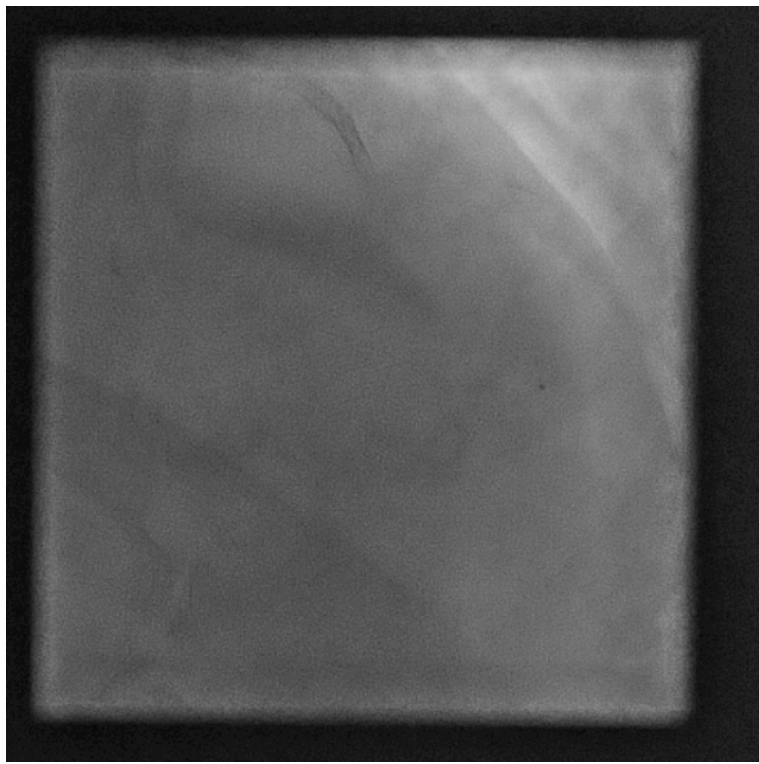
1 – Perforation de la coronaire droite : Ping pong technique



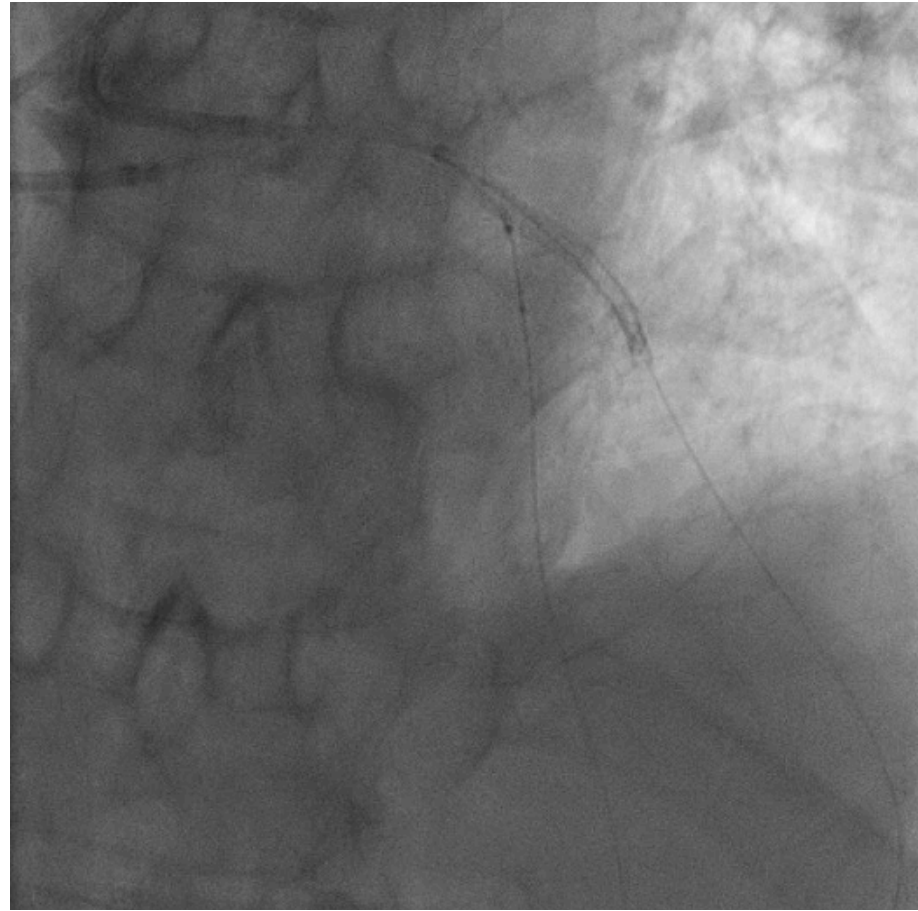
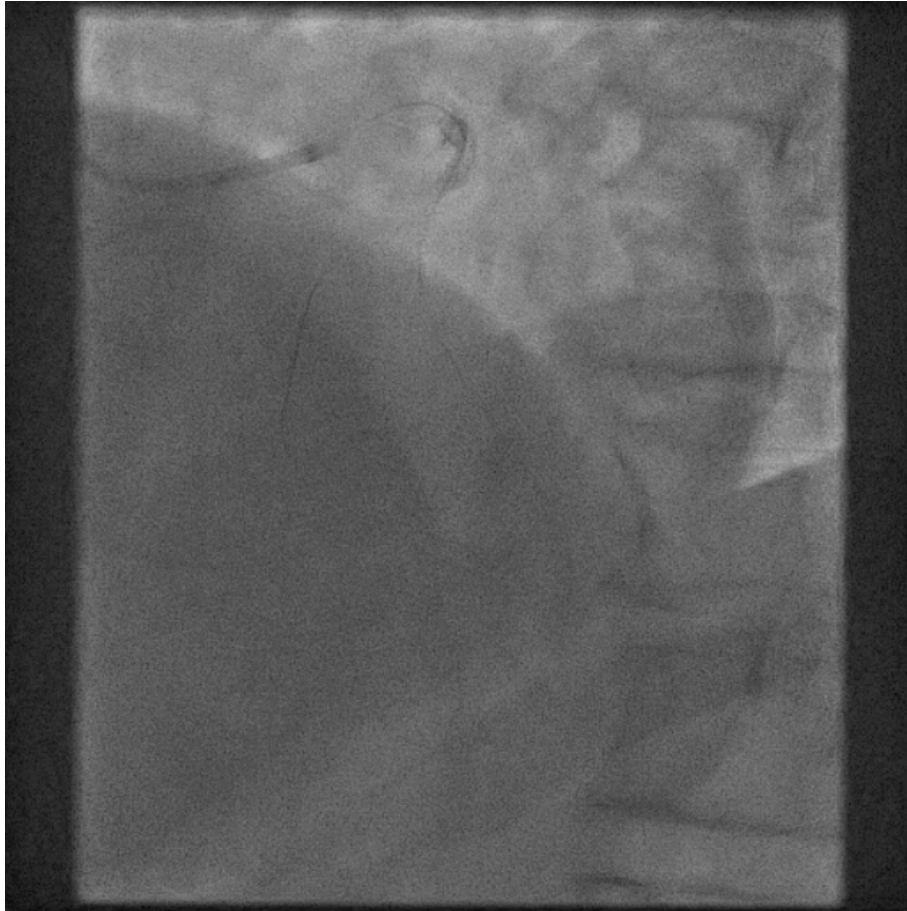
2 – CTO IVA



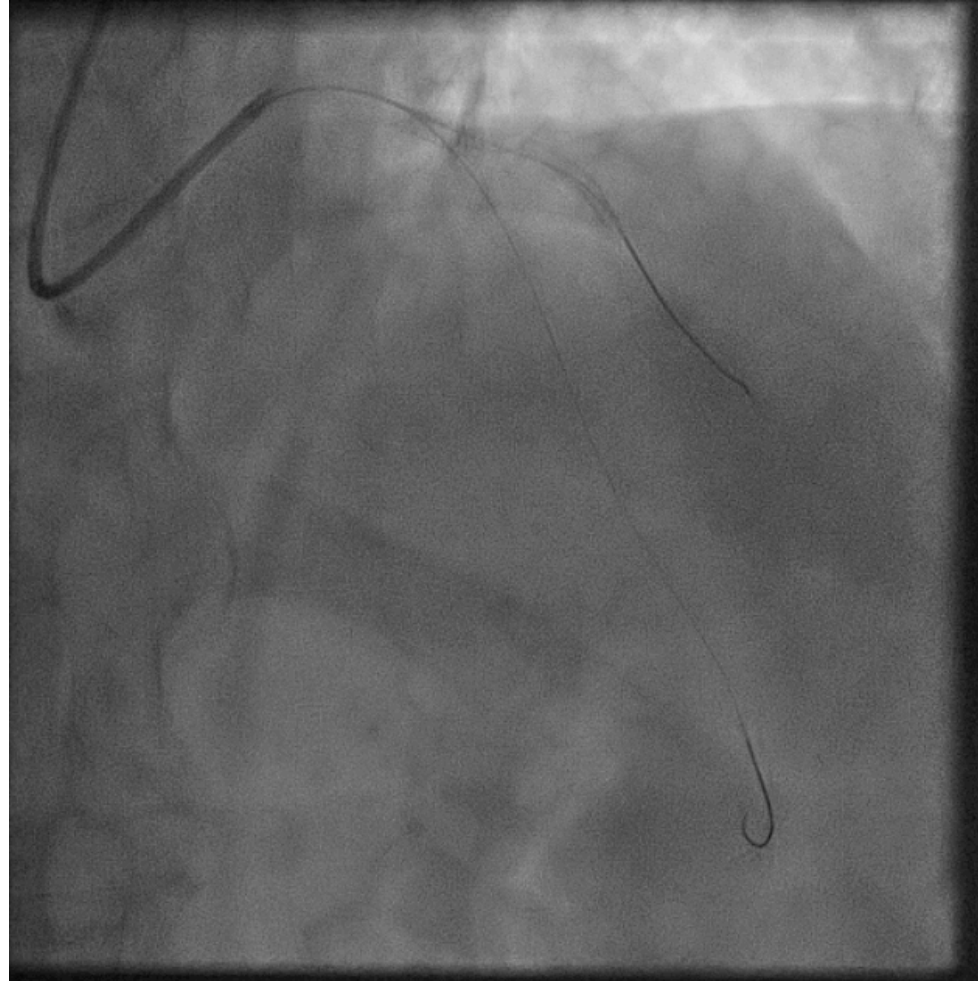
2 – CTO IVA



2 – CTO IVA



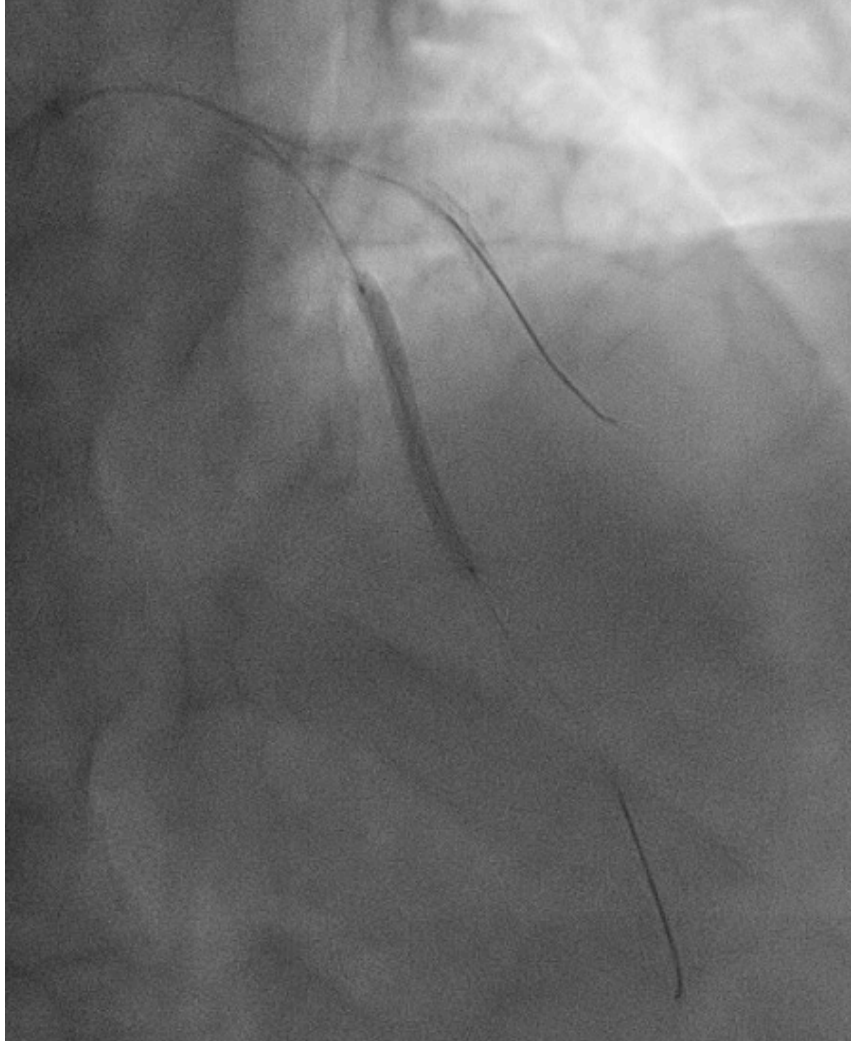
2 – CTO IVA



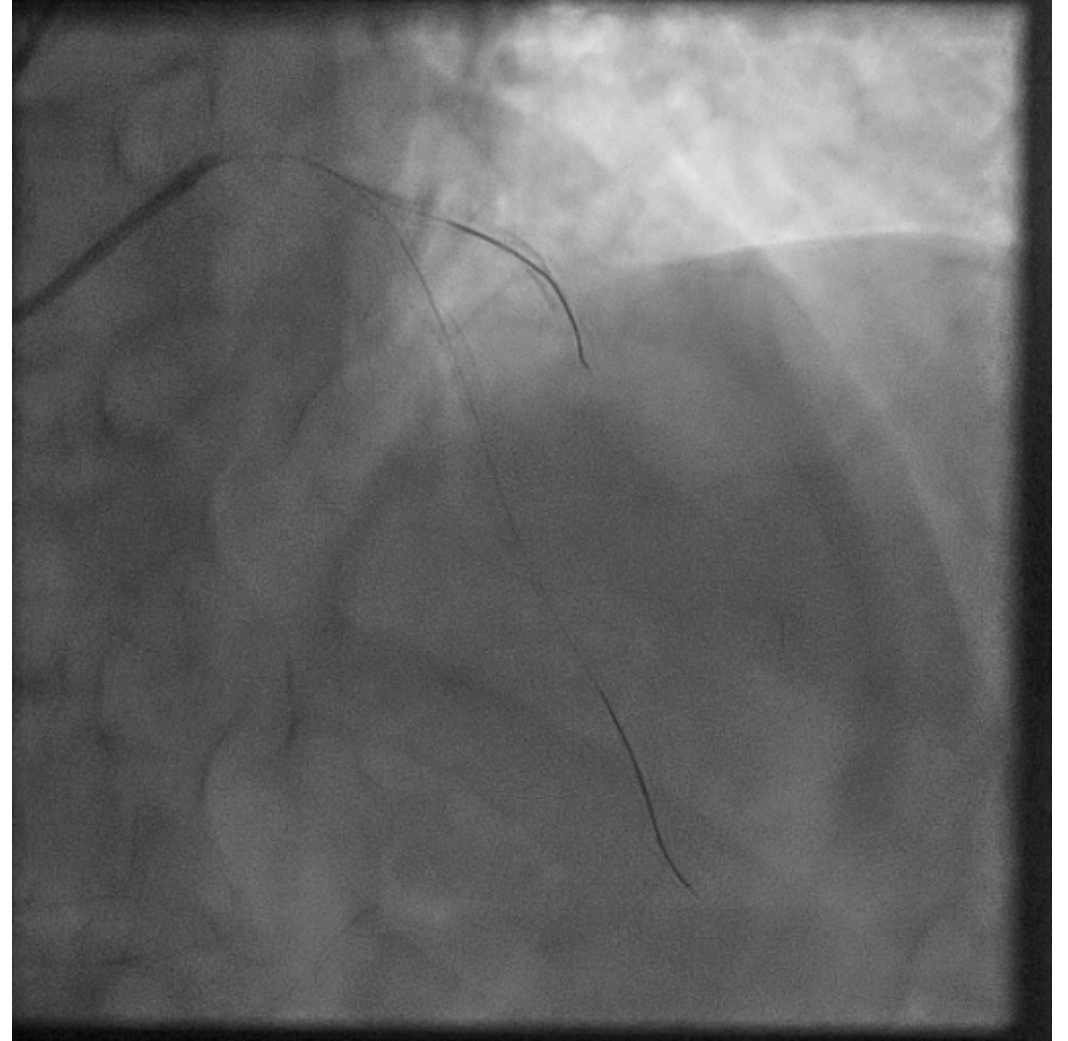
Technique Culotte

Lésion d'aval IVA, persistante
après dérivés nitrés

2 – CTO IVA

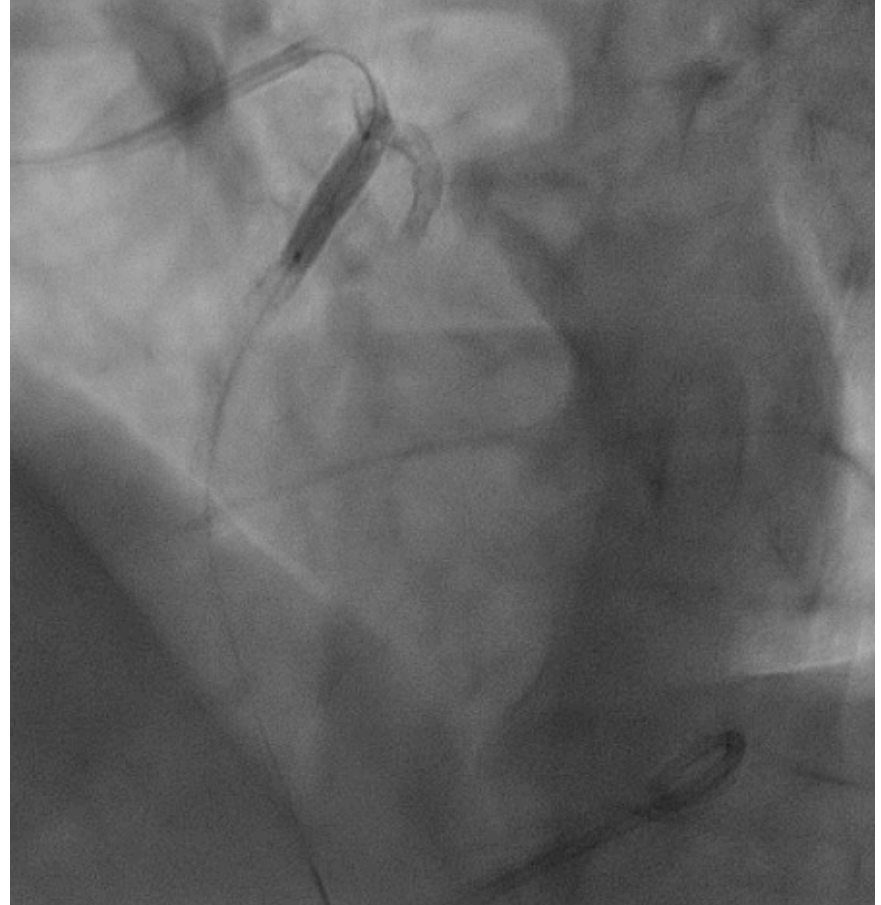
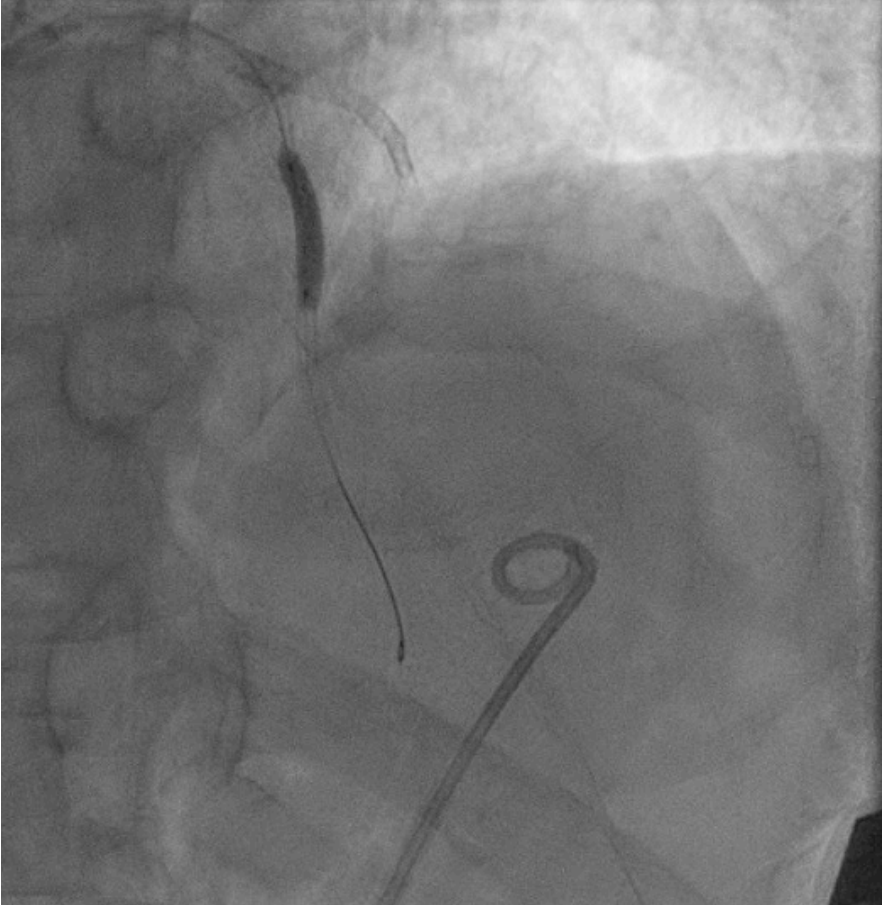


Implantation d'un stent en aval



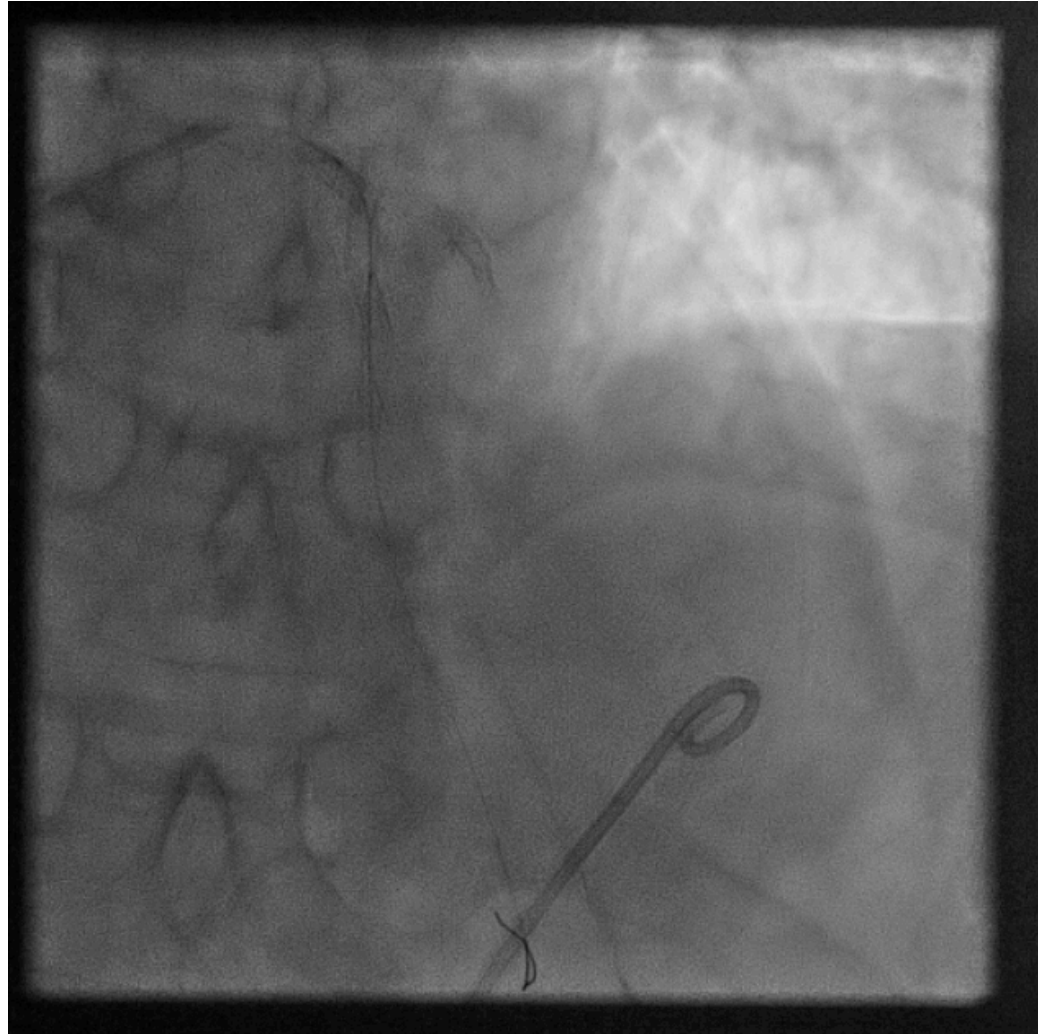
Résultat post stent....

2 – CTO IVA



- Drainage péricardique percutané
- 2 stents couverts , PK Papyrus
- Echo

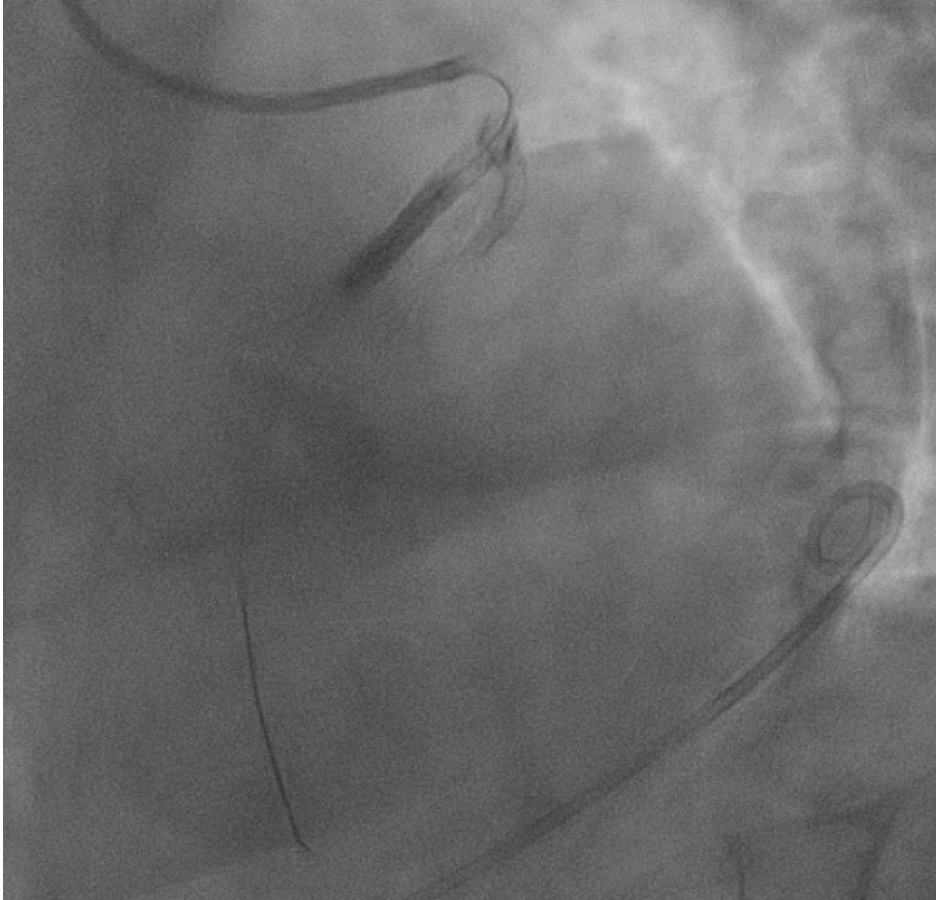
2 – CTO IVA



Résultat post stent couvert...

Que faire ?

2 – CTO IVA



Hypothèses:

- **Mal-apposition des stents couverts?**
- **Dissection en aval ou amont ?(zone de réentrée vers la perforation)**

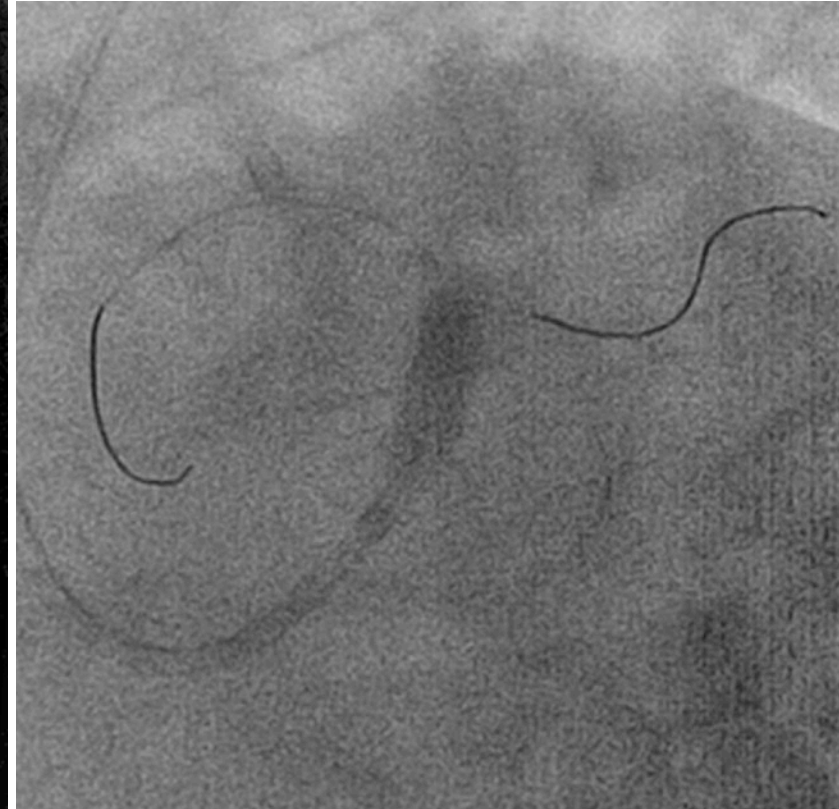
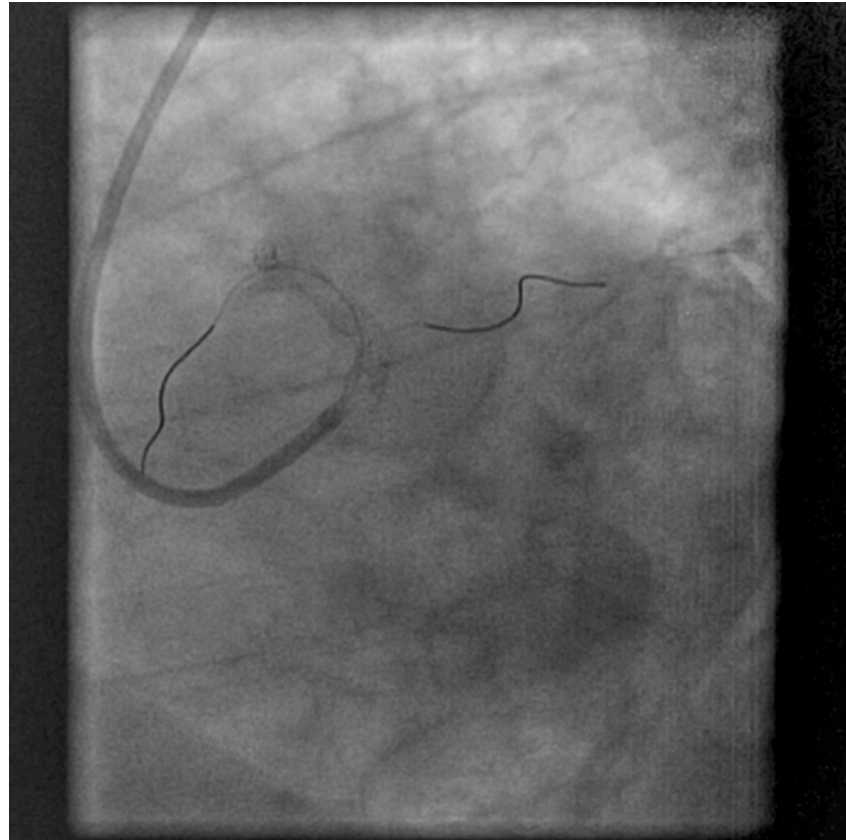
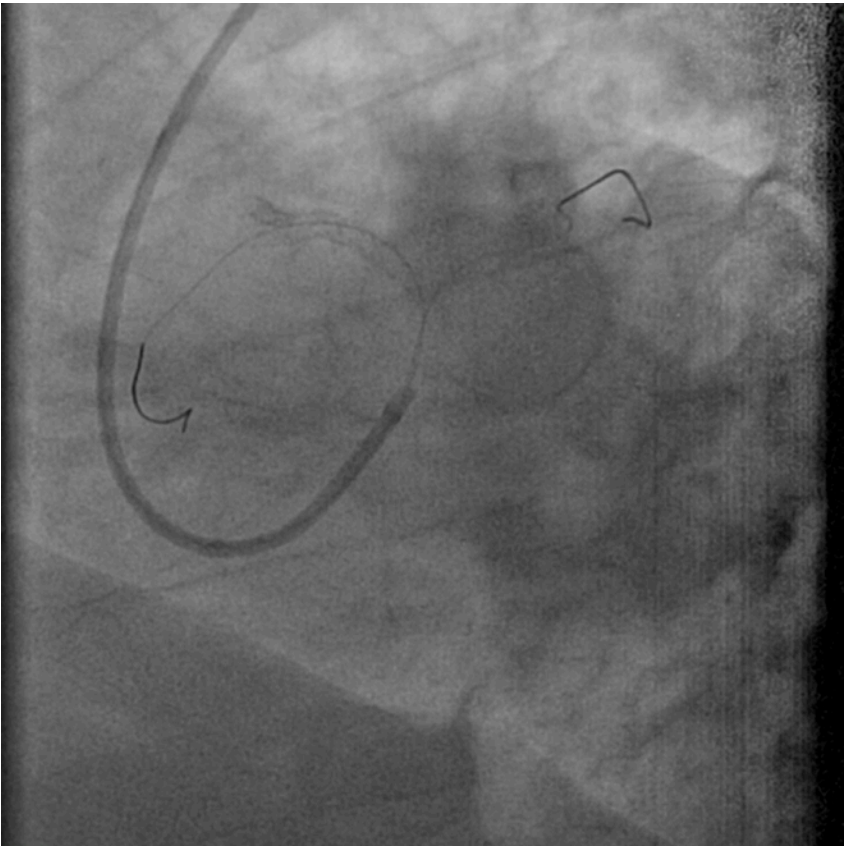
→ Post-dilatation

2 – CTO IVA



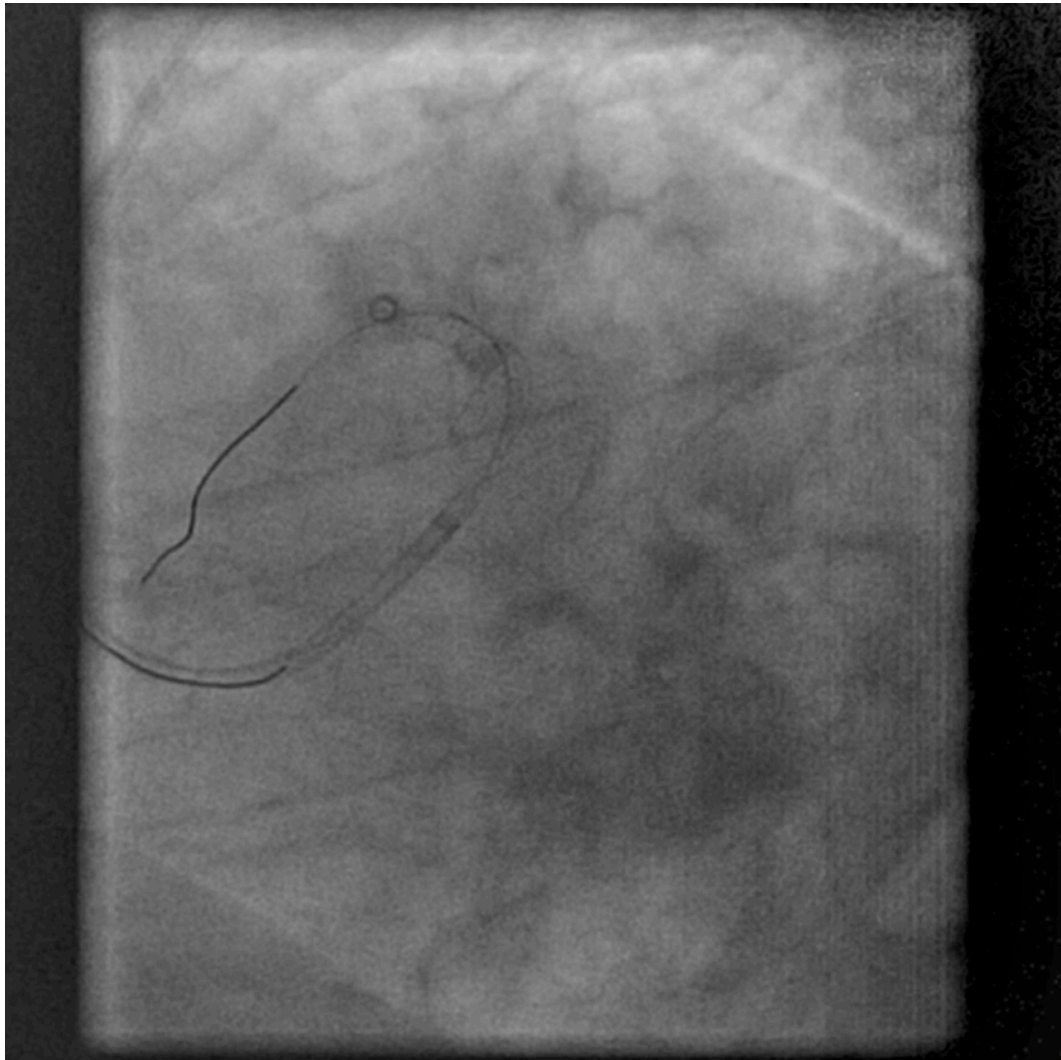
**Correction de la perforation après post
dilatation des stents couverts**

3 – Tronc commun gauche



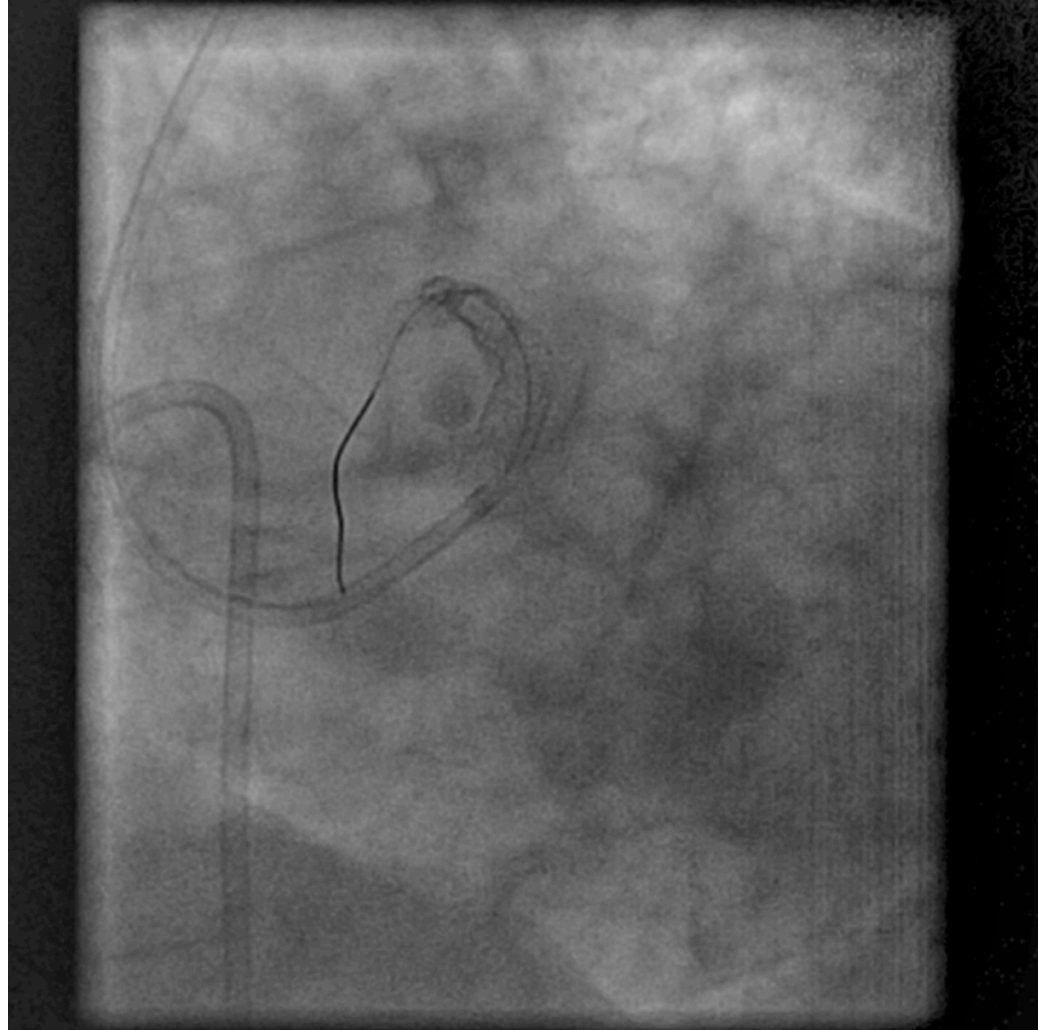
Stenting TCG-IVA et POT au ballon de 4,5 mm

3 – Tronc commun gauche



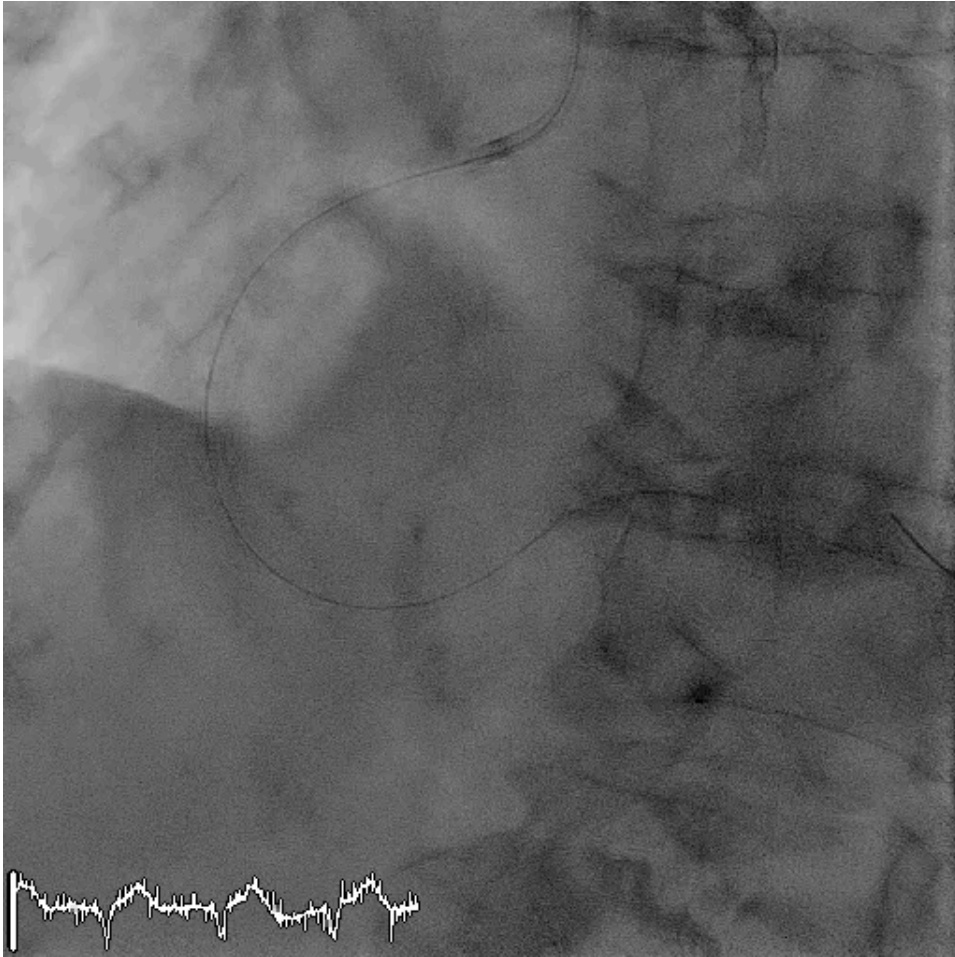
Stent PKP (4x15mm). Drainage péricardique percutané (600 mL).

3 – Tronc commun gauche

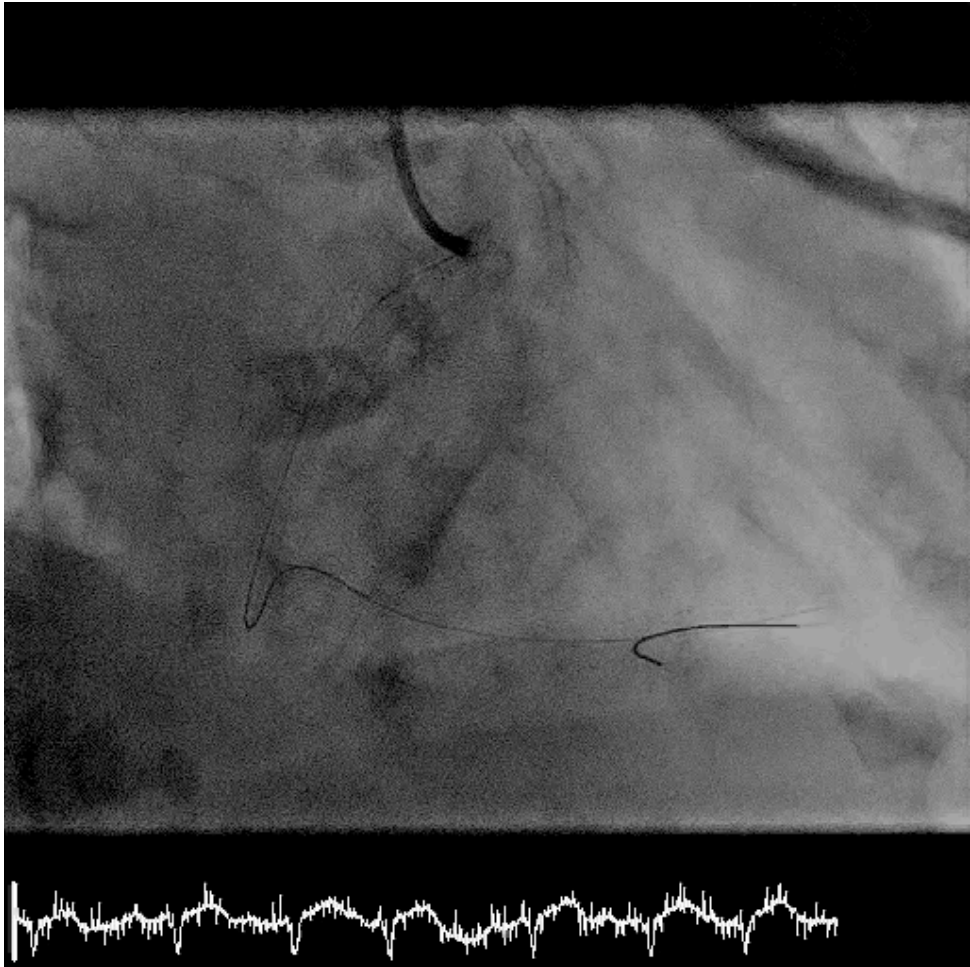


Post dilatation TCG au ballon de 4,5 mm

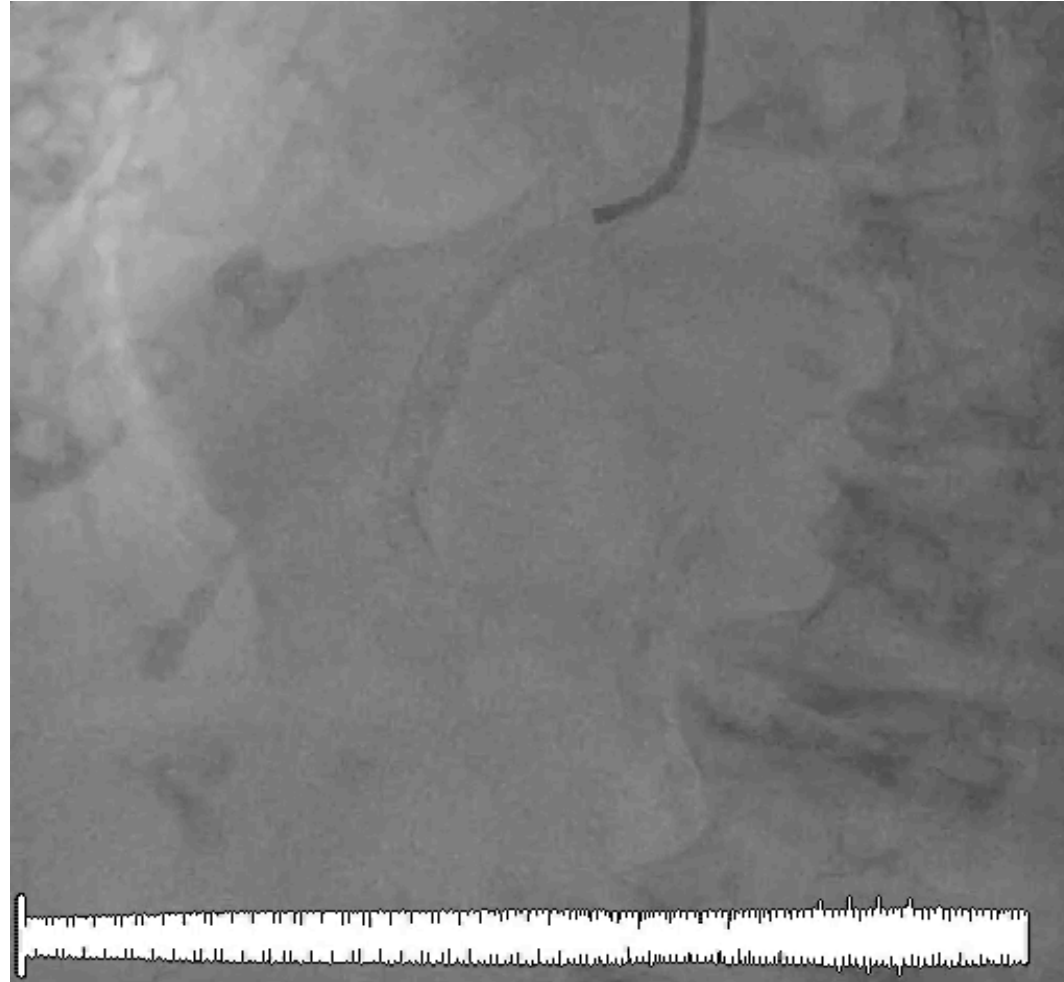
4 – Faux anévrysme post ATC



4 – Faux anévrisme post ATC

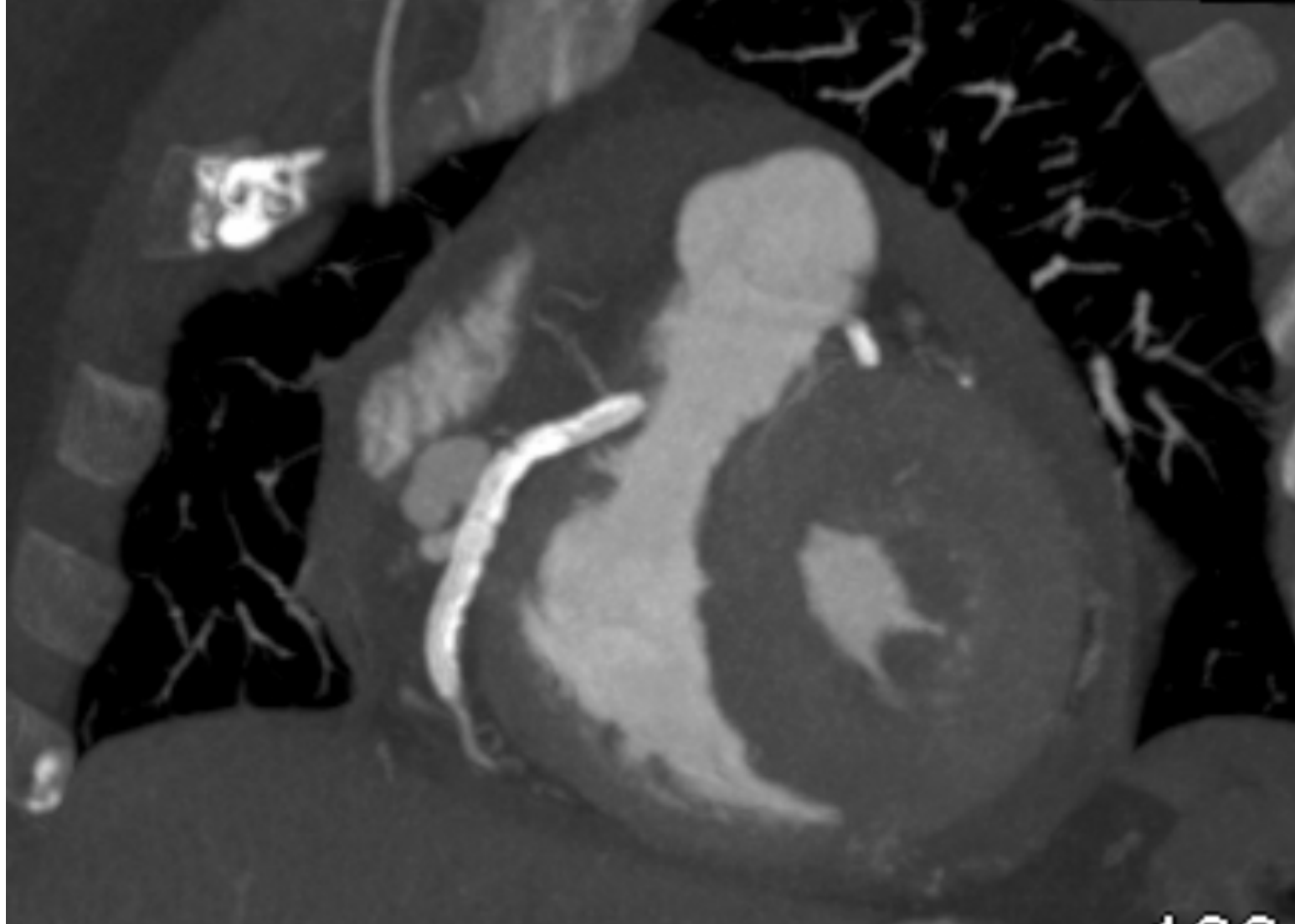


4 – Faux anévrisme post ATC

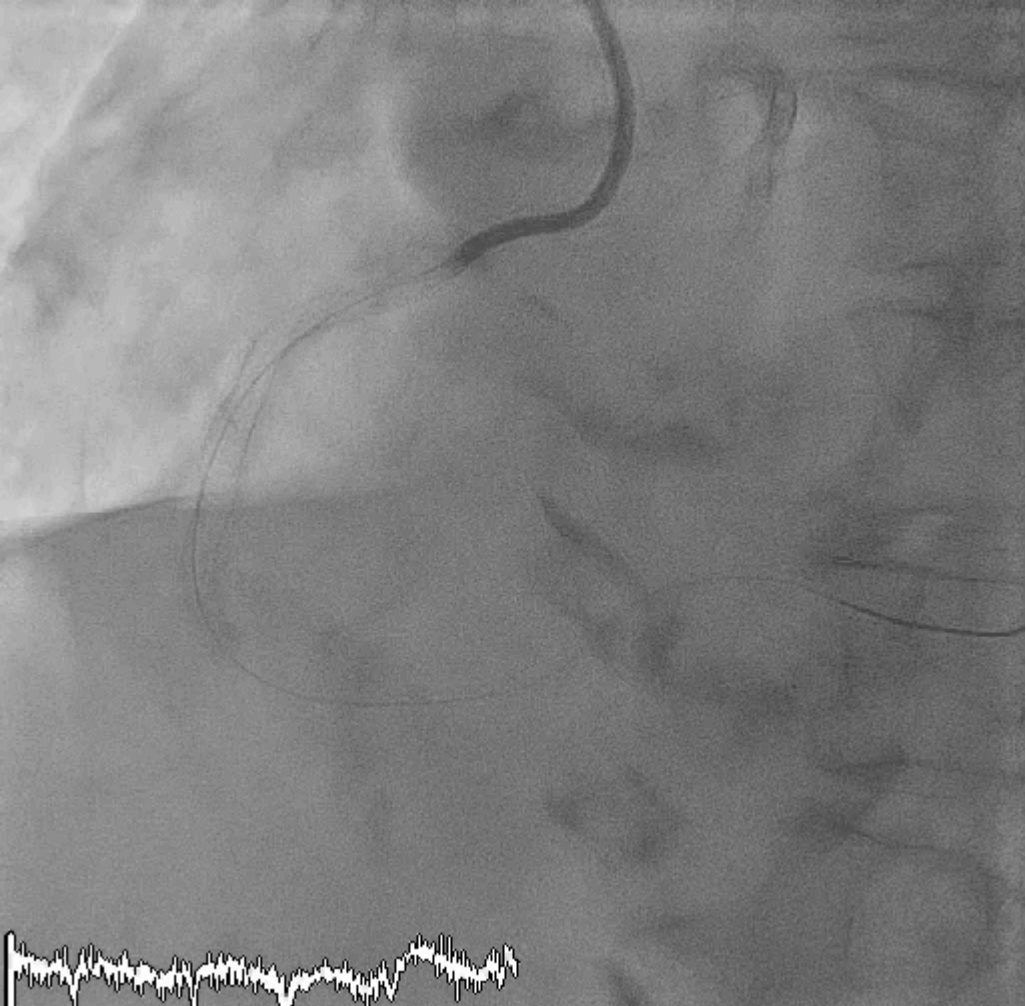
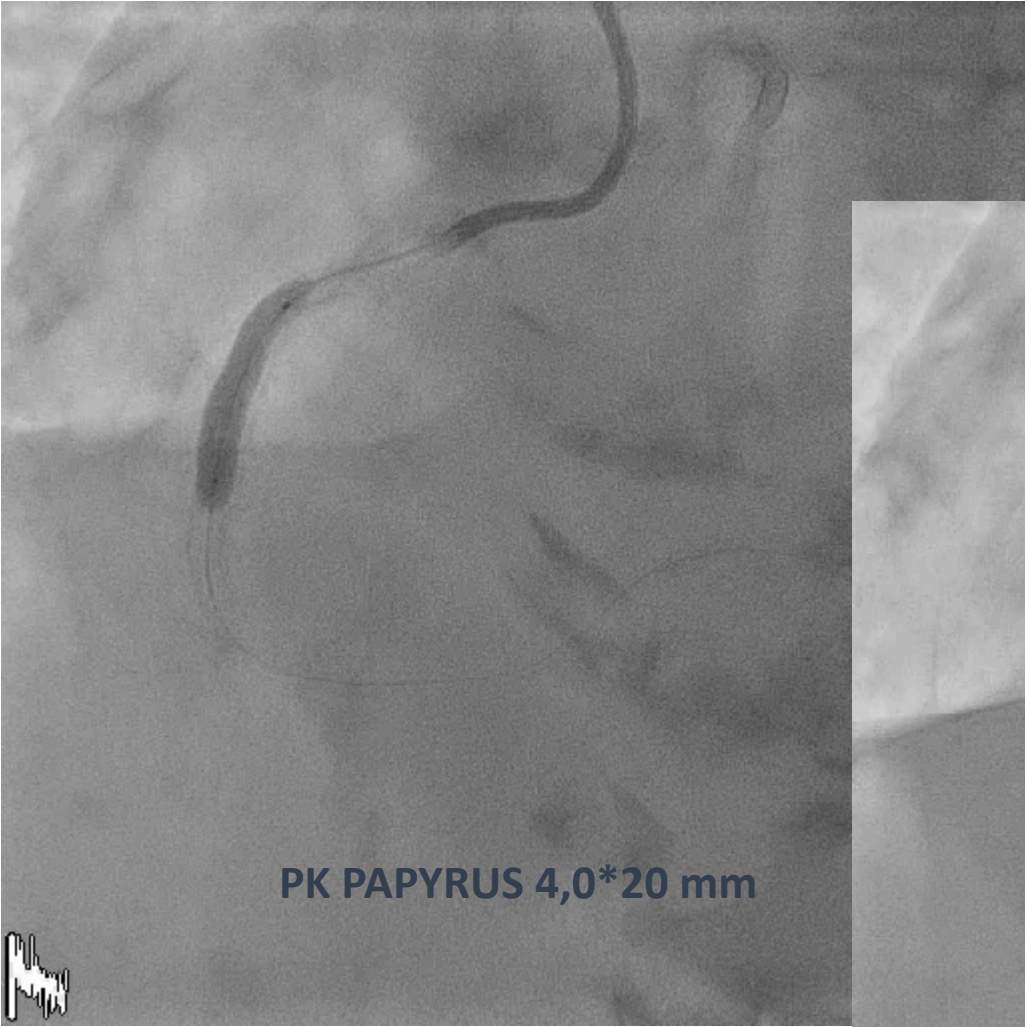


Contrôle A J15 post OAP

4 – Faux anévrysme post ATC







4 – Faux anévrysme post ATC

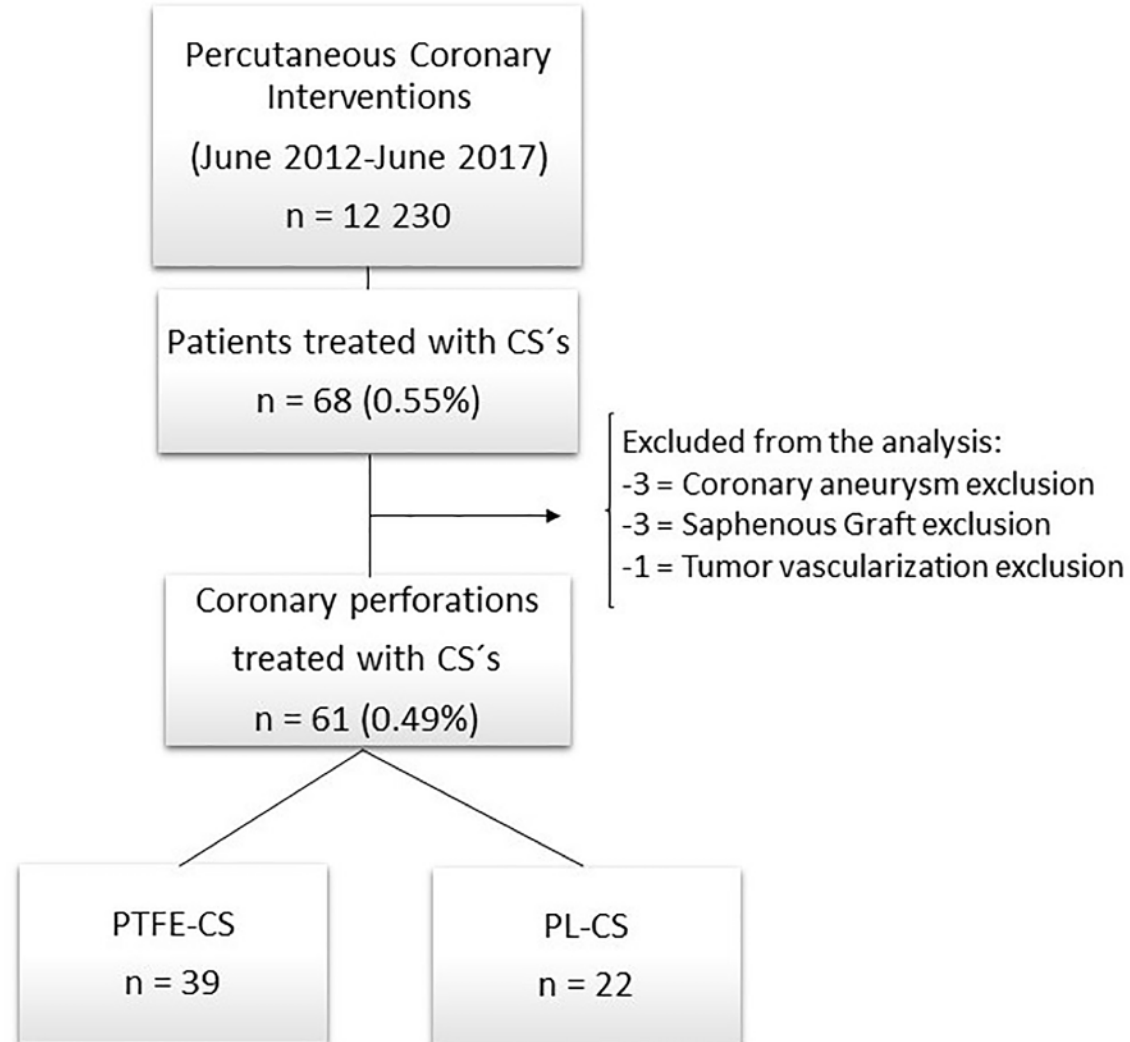


ORIGINAL INVESTIGATION

Outcomes after use of covered stent perforations. Comparison of old and new stents

Marco Hernández-Enríquez MD^{1,2}  | Olivier Laine MD¹ 
Francisco Campelo-Parada MD²  | Thibault Lherminier MD² 
Frédéric Bouisset MD² | Jérôme Roncalli MD, PhD² | Didier Carrié MD, PhD² | Nicolas Boudou MD²

J Interv Cardiol. 2018;1-7.



→ In this comparison between PTFE CS and PK Papyrus



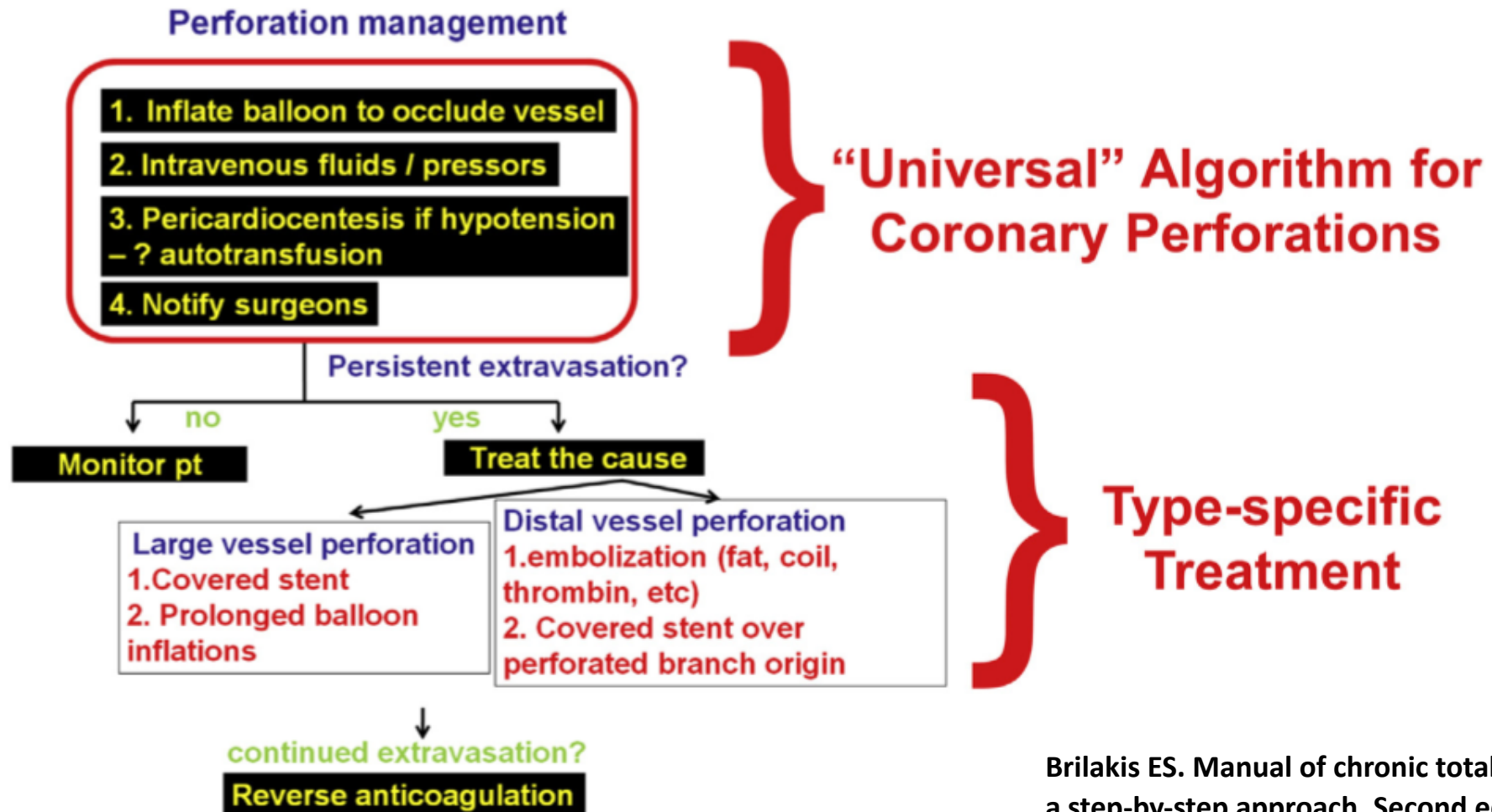
Traditional sandwich design stent¹



PK Papyrus
Covered single stent design

1. Time to deliver was shorter with PK Papyrus
2. Lower rate of pericardial effusion and cardiac arrest with PK Papyrus
3. No significant differences in procedural success and 1-year follow-up MACE
4. Larger and prospective registries are needed.

Conclusion



Conclusion

- Stents couverts **indispensables** en salle de cathétérisme cardiaque
- Prise en charge des perforations **rapide et standardisée** (algorithme – matériel rapidement disponible)
- **Appeler un ami**
- Intérêt des **stents couverts de dernière génération**
- **Post dilatation** des stents couverts +++

5 6 7
JUN 2019





Back up slides

Classification

Ellis Classification

Table 1. Ellis classification of coronary perforations.

Ellis class	Definition
I	Crater extending outside the lumen only and in the absence of linear staining angiographically suggestive of a dissection
II	Pericardial or myocardial blush without a ≥ 1 mm exit hole
III	Frank streaming of contrast through a ≥ 1 mm exit hole
III with cavity spilling (IIICS)	Perforation into an anatomic cavity chamber or coronary sinus



PK Papyrus covered stent: Device description and early experience for the treatment of coronary artery perforations

David E. Kandzari¹ | Ralf Birkemeyer²

Catheter Cardiovasc Interv. 2019;1-5.

Characteristic	N = 80 patients
Perforation classification	
I	10.0 (8)
II	15.0 (12)
III	50.0 (40)
III-cavity spilling	17.5 (14)
Class not provided	7.5 (6)
Perforation site	
Left main artery	2.5 (2)
Left anterior descending artery	48.8 (39)
Left circumflex artery	21.3 (17)
Right coronary artery	23.8 (19)
Bypass graft	3.8 (3)

Characteristic	N = 80 patients
Interventions prior to PK Papyrus stent implantation	
Prolonged balloon inflation	57.5 (46)
Conventional stent	8.8 (7)
Alternative covered stent	2.5 (2)
Coil embolization	2.5 (2)
Protamine administration	1.3 (1)
None	33.8 (27)
Pericardiocentesis	8.8 (7)
Emergency surgery	0
PK Papyrus stent diameter, mm (N = 93 stents)	3.0 ± 0.5
PK Papyrus stent length, mm (N = 93 stents)	17.9 ± 2.9
Successful delivery to perforation site	95.0 (76)
Successful perforation sealing	91.3 (73)
Sealing among successful delivery cases (N = 76)	96.1 (73)

Data represented as percent (N) or mean ± SD.

BASELINE CHARACTERISTICS

	Total (n=61)	PTFE CS (n=39)	PL CS (n=22)	p
Age (years)	77 [11]	75 [13]	79 [12]	0.815
Male gender	46 (75%)	29 (74%)	17 (77%)	1
Hypertension	38 (62%)	22 (56%)	16 (73%)	0.275
Dyslipidemia	35 (57%)	25 (64%)	10 (46%)	0.186
Diabetes	20 (33%)	12 (31%)	8 (36%)	0.778
Previous MI	26 (43%)	15 (38%)	11 (50%)	0.428
Previous CABG	8 (13%)	3 (8%)	5 (23%)	0.124
LVEF (%)	50 [20]	50 [20]	50 [15]	0.521
GFR (mL/min)	59 [32]	59 [26]	60 [48]	0.575
Three-vessel disease	29 (48%)	18 (46%)	11 (50%)	0.796

LESION CHARACTERISTICS

	Total (n=61)	PTFE CS (n=39)	PL CS (n=22)	p
Type C	42 (69%)	26 (67%)	16 (73%)	0.775
Length >20mm	36 (59%)	23 (59%)	13 (59%)	1.000
Calcification	39 (64%)	21 (54%)	18 (82%)	0.051
CTO	13 (21%)	8 (21%)	5 (23%)	1.000
Ellisgrade III	55 (90%)	36 (92%)	19 (86%)	0.658
Vessel				
LAD	33 (54%)	25 (64%)	8 (36%)	0.060
RCA	17 (28%)	9 (23%)	8 (36%)	0.373
Mechanism of rupture				
Rotational atherectomy	3 (5%)	2 (5%)	1 (5%)	1.000
Pre-dilatation	12 (20%)	9 (23%)	3 (14%)	0.509
Stenting	27 (44%)	17 (44%)	10 (46%)	1.000
Post-dilatation	18 (30%)	10 (26%)	8 (36%)	0.397

PROCEDURAL OUTCOMES

	Total (n=61)	PTFE CS (n=39)	PL CS (n=22)	p
Delivery success	57 (93%)	35 (90%)	22 (100%)	0.287
Procedural success	46 (75%)	27 (69%)	19 (86%)	0.216
Time to deliver (min)	12 [14]	15 [16]	8 [11]	0.001
Number of CS implanted	1 [0.5]	1 [0]	1 [1]	0.330
CS diameter (mm)	3.5 [0.75]	3.5 [0.70]	3.5 [1]	0.205
CS length (mm)	16 [4]	16 [3]	20 [5]	<0.001
CS post-dilatation	23 (38%)	13 (33%)	10 (46%)	0.415

PROCEDURAL COMPLICATIONS

	Total (n=61)	PTFE CS (n=39)	PL CS (n=22)	p
Side branch occlusion	6 (10%)	4 (10%)	2 (9%)	1.000
Bradycardia	6 (10%)	4 (10%)	2 (9%)	1.000
Pericardial effusion	37 (61%)	28 (72%)	9 (41%)	0.028
Cardiac Tamponade	24 (39%)	16 (41%)	8 (36%)	0.790
Pericardiocentesis	23 (38%)	15 (38%)	8 (36%)	1.000
Cardiac arrest	11 (18%)	10 (26%)	1 (5%)	0.045
Vasoactive drugs	32 (52%)	22 (56%)	10 (45%)	0.437
IABP	4 (7%)	4 (10%)	0 (0)	0.287
ECMO	2 (3%)	2 (5%)	0 (0)	0.531
Emergent surgery	7 (11%)	5 (13%)	2 (9%)	1.000

OUTCOMES AT 1-YEAR FOLLOW-UP

	Total (n=58)	PTFE CS (n=39)	PL CS (n=19)	p
MACE	33 (57%)	22 (56%)	11 (58%)	1.000
All-cause death	21 (36%)	16 (41%)	5 (26%)	0.385
Myocardial infarction	5 (9%)	3 (8%)	2 (11%)	1.000
TLR	4 (7%)	1 (3%)	3 (16%)	0.098
TVR	6 (10%)	2 (5%)	4 (21%)	0.083
Surgical repair	9 (16%)	6 (15%)	3 (16%)	1.000
Stent thrombosis	2 (4%)	1 (3%)	1 (6%)	0.544
In-stent restenosis	3 (6%)	1 (3%)	2 (12%)	0.223
FU-angio	18 (31%)	9 (23%)	9 (41%)	0.158

2 – Anévrysme post sténotique

