The interim result of pre-emptive AVF approach versus usual care
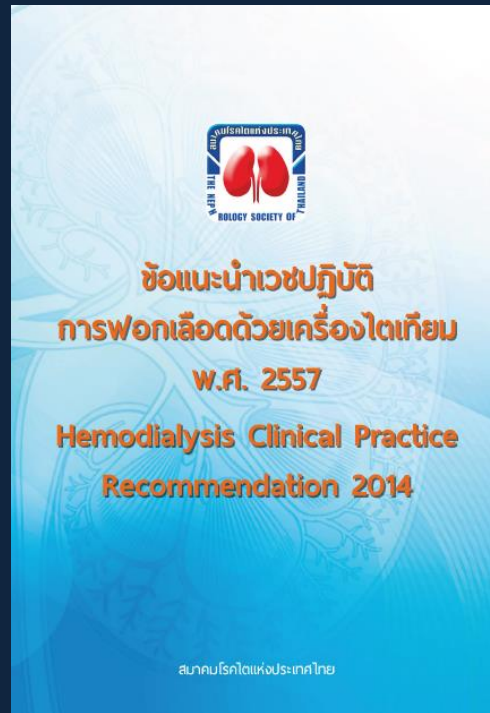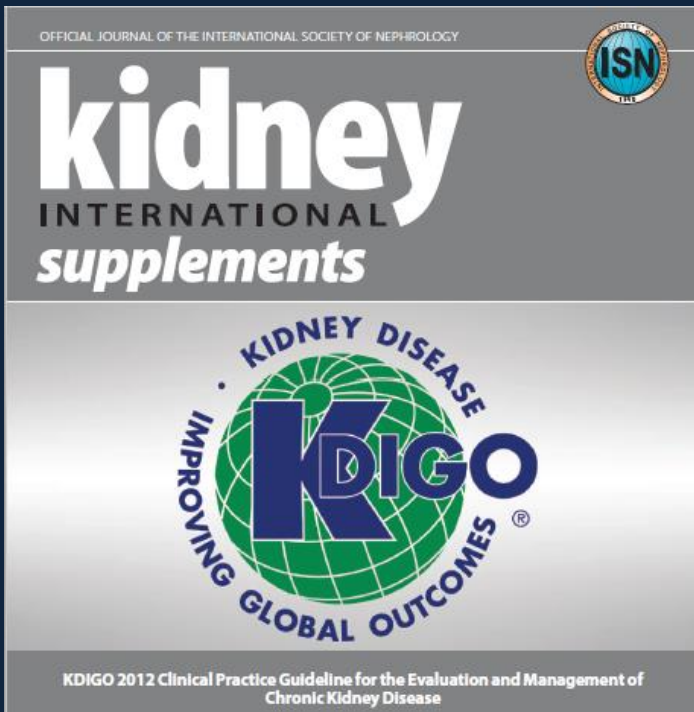

Professor Kittipan Rerkasem, MD, PhD, FRCS(T)
Faculty of Medicine and
Research Institute of Health Science
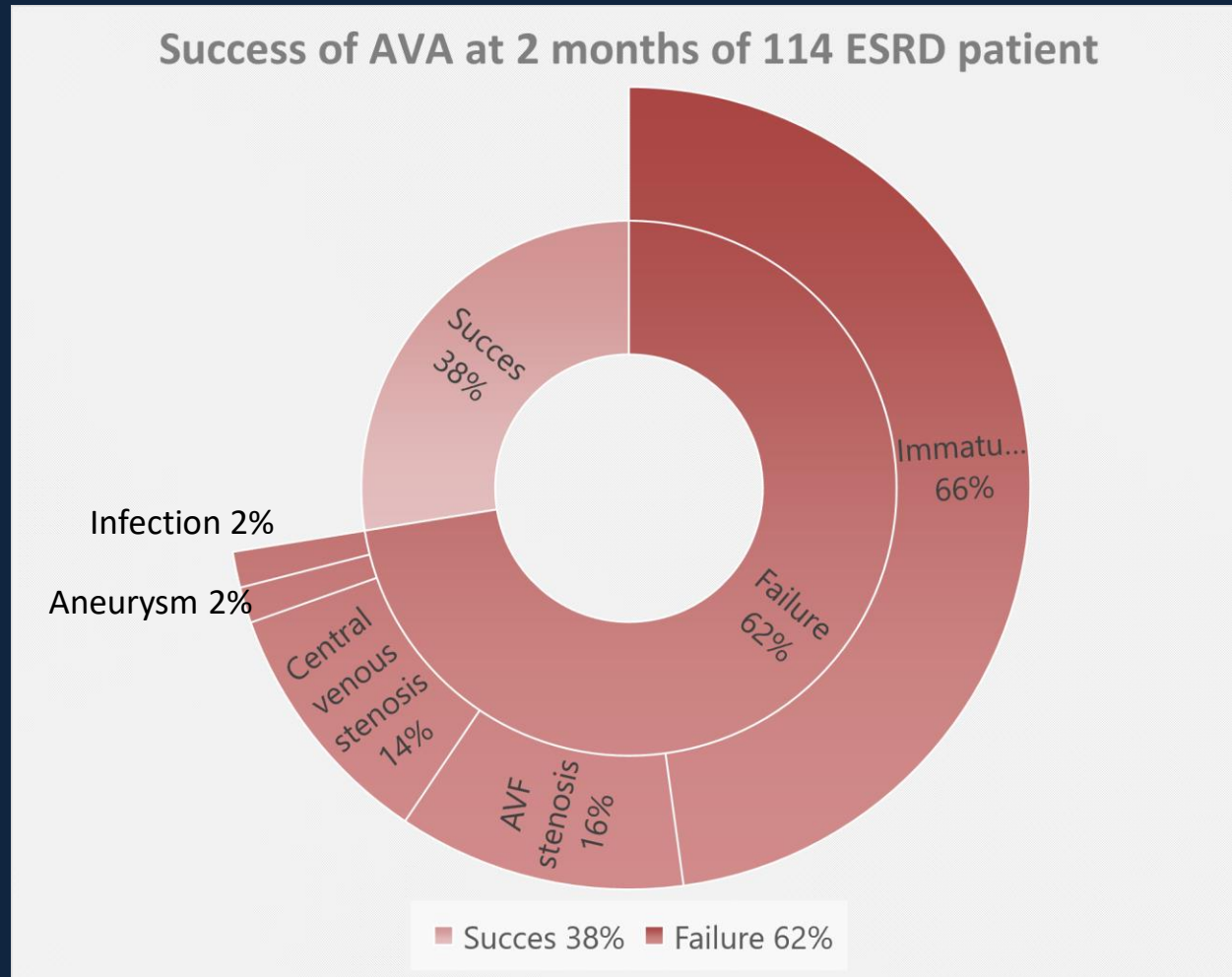**Chiang Mai University**

Background and literature review

- Avoid central venous catheterization (CVC)

- < 20%

The Nephrology Society of Thailand. Hemodialysis Clinical Practice Recommendation 2014

AVA Situation in Maharaj Hospital 2014

Success of AVA at 2 months of 114 ESRD patient

- Succes 38%
- Immatu... 66%
- Failure 62%
- Infection 2%
- Aneurysm 2%
- Central venous stenosis 14%
- AVF stenosis 16%

Succes 38% Failure 62%

- History of Previous CVC 88%
- Retained CVC for HD 10 months before AVF
- AVG 60% AVF 40%

Background and literature review

Why the usual care did not follow the Guideline?

- Delayed referral for AVA surgery
- Not to preserved arm vein
- Emergency HD (through catheter)
- Poor Surveillance

Objective

To compare Developed New Protocol

Express protocol in Northern Thailand (EPNT)

Vs

Usual standard care in the outcome

Methodology

- Non-randomized Prospective study

- Population : ESRD Patient with AVA at Maharaj hospital and Chiang Rai Prachanukroh hospital

- Date: September 2016 – September 2019

Methodology

Inclusion criteria

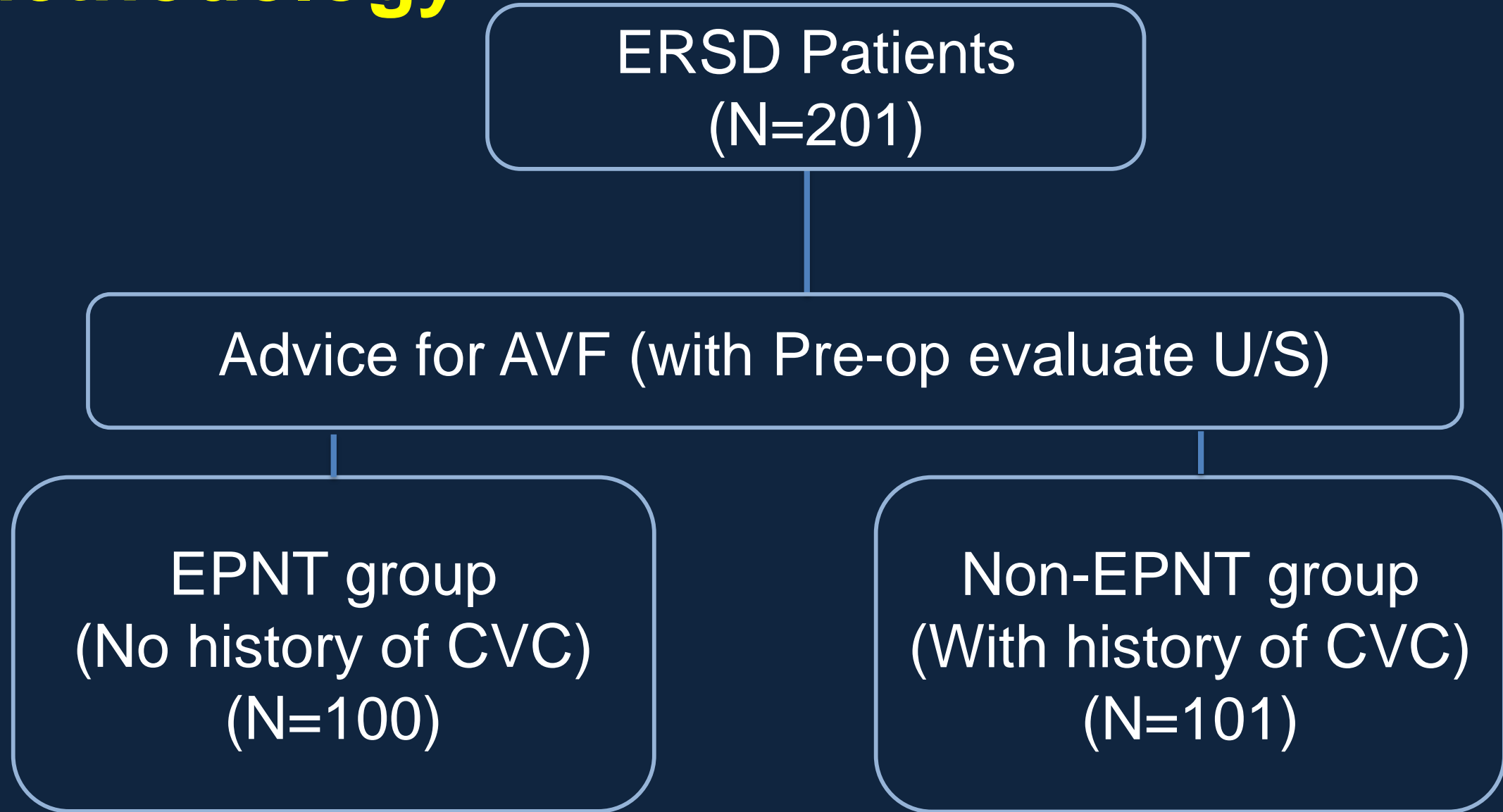- Age > 18 yrs
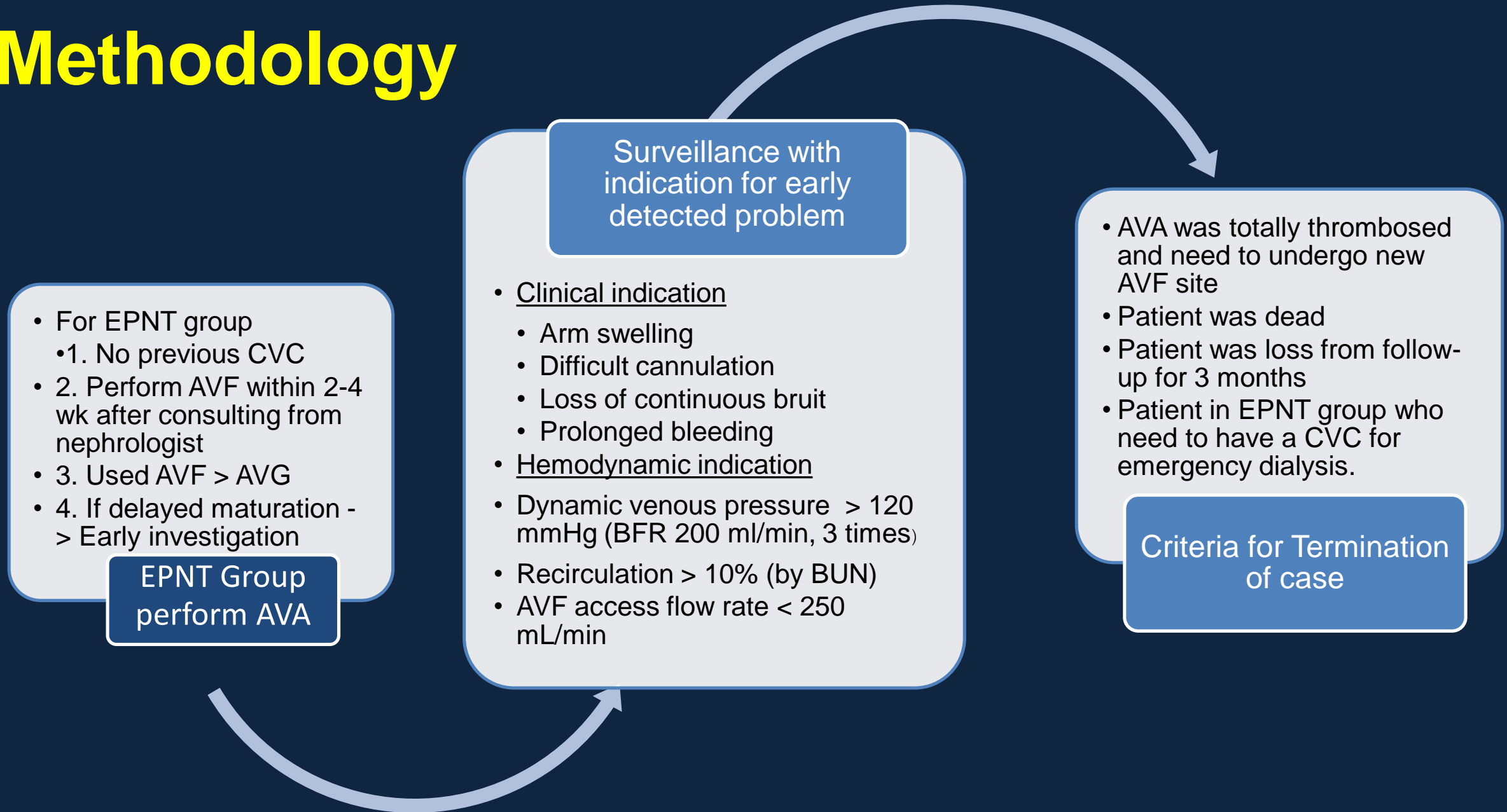- ESRD Patient who come to operated new AVA site

Exclusion criteria

- On Pacemaker or defibrillator
- History of Central vein stenosis and Post-radiation therapy

A. K. Agarwal. Central vein stenosis. Am J Kidney Dis. 2013;61(6):1001-15.

Methodology

Methodology

EPNT Group perform AVA

- For EPNT group
  - 1. No previous CVC
- 2. Perform AVF within 2-4 wk after consulting from nephrologist
- 3. Used AVF > AVG
- 4. If delayed maturation -> Early investigation

Surveillance with indication for early detected problem

- Clinical indication
  - Arm swelling
  - Difficult cannulation
  - Loss of continuous bruit
  - Prolonged bleeding
- Hemodynamic indication
- Dynamic venous pressure > 120 mmHg (BFR 200 ml/min, 3 times)
- Recirculation > 10% (by BUN)
- AVF access flow rate < 250 mL/min

Criteria for Termination of case

- AVA was totally thrombosed and need to undergo new AVF site
- Patient was dead
- Patient was loss from follow-up for 3 months
- Patient in EPNT group who need to have a CVC for emergency dialysis.

Methodology

Follow up : AVF Surveillance as protocol for 15 months (Plan 24 months)

Outcome :

1 Primary outcome (every 3 months)
- AVA patency (maturation) and complication
  Thrombosis, Stenosis, Sepsis, Central venous stenosis

2 Secondary outcome
- Quality of life : Short Form 36 (every 6 months)

Statistical methods: Chi-Squared test (Fisher exact test)
KM curve, Log rank test

Result and Discussion

Result :General data

| Characteristics	EPNT (n = 100)	Non-EPNT (n = 101)	Total (n = 201)	Statistics, p - value
Age (years)				
< 30	0	2 (1.98)	2 (1.00)	χ^2-test =5.1806, df=5
30 – 39	3 (3.00)	8 (7.92)	11 (5.47)	p =0.394
40 – 49	7 (7.00)	9 (8.91)	16 (7.96)	
50 – 59	31 (31.00)	28 (27.72)	59 (29.35)	
60 – 69	32 (32.00)	32 (31.68)	64 (31.84)	
≥ 70	27 (27.00)	22 (21.78)	49 (24.38)	
Mean ± SD	62.81 ± 11.76	59.23 ± 12.81	61.01 ± 12.40	t-test =2.0646, df= 199
Median	62	60	61	p = 0.0403
Min. – Max.	31 – 86	27 – 85	27 – 86	
Gender				
Male	55 (55.00)	52 (51.49)	107 (53.23)	χ^2-test =0.2494, df=1
Female	45 (45.00)	49 (48.51)	94 (46.77)	p =0.618

Result : Atherosclerotic risk factor

Cardiovascular risk factors	EPNT (n = 100)	Non-EPNT (n = 101)	Total (n = 201)	Statistics, *p* - value
A. Atherosclerotic risk factors				
1. Hypertension	91 (91.00)	87 (86.14)	178 (88.56)	$\chi^2_{(1)}$-test=1.17 , p=0.279
2. Dyslipidemia or currently treated with lipid modifying agent	62 (62.00)	56 (55.45)	118 (58.71)	$\chi^2_{(1)}$-test =0.89,p=0.345
3. Diabetic	46 (46.00)	40 (39.60)	86 (42.79)	$\chi^2_{(1)}$-test=0.84, p=0.359
- Type 1	2 (2.00)	2 (1.98)	4 (1.99)	
- Type 2	44 (44.00)	38 (37.62)	82 (40.80)	
4. COPD	0	0	0	
5. Smoking				
- Never	64 (64.00)	57 (56.44)	121 (60.20)	Exact test: p = 0.504
- Former	33 (33.00)	40 (39.60)	73 (36.32)	
- Current (≤ 1 cigarette / day)	2 (2.00)	1 (0.99)	3 (1.49)	
- Current (> 1 cigarette / day)	1 (1.00)	3 (2.97)	4 (1.99)	

No statistically significant

Result : Atherosclerotic risk factor

Cardiovascular risk factors	EPNT (n = 100)	Non-EPNT (n = 101)	Total (n = 201)	Statistics, *p* - value
B. Previous history of cardiovascular events				
1. Chronic stable angina	2 (2.00)	1 (0.99)	3 (1.49)	Exact test: p = 0.621
2. Myocardial infarction	2 (2.00)	3 (2.97)	5 (2.49)	Exact test: p = 1.000
3. Unstable angina	0	3 (2.97)	3 (1.49)	Exact test: p = 0.246
4. Stroke (ischemic)	5 (5.00)	1 (0.99)	6 (2.99)	Exact test: p= 0.118
5. Transient ischemic attack	0	0	0	
6. Peripheral arterial disease	2 (2.00)	1 (0.99)	3 (1.49)	Exact test: p = 0.621
If yes,				
6.1 intermittent claudication	2 (2.00)	0	2 (1.00)	Exact test: p =0.246
6.2 rest pain	1 (1.00)	0	1 (0.50)	Exact test: p =0.498
6.3 gangrene	0	0	0	
6.4 chronic ulcer	0	1 (0.99)	1 (0.50)	Exact test: p = 1.000
7. Chronic heart failure	1 (1.00)	0	1 (0.50)	Exact test: p = 0.498
8. History of arrhythmia	0	4 (3.96)	4 (1.99)	Exact test: p = 0.121

No statistically significant
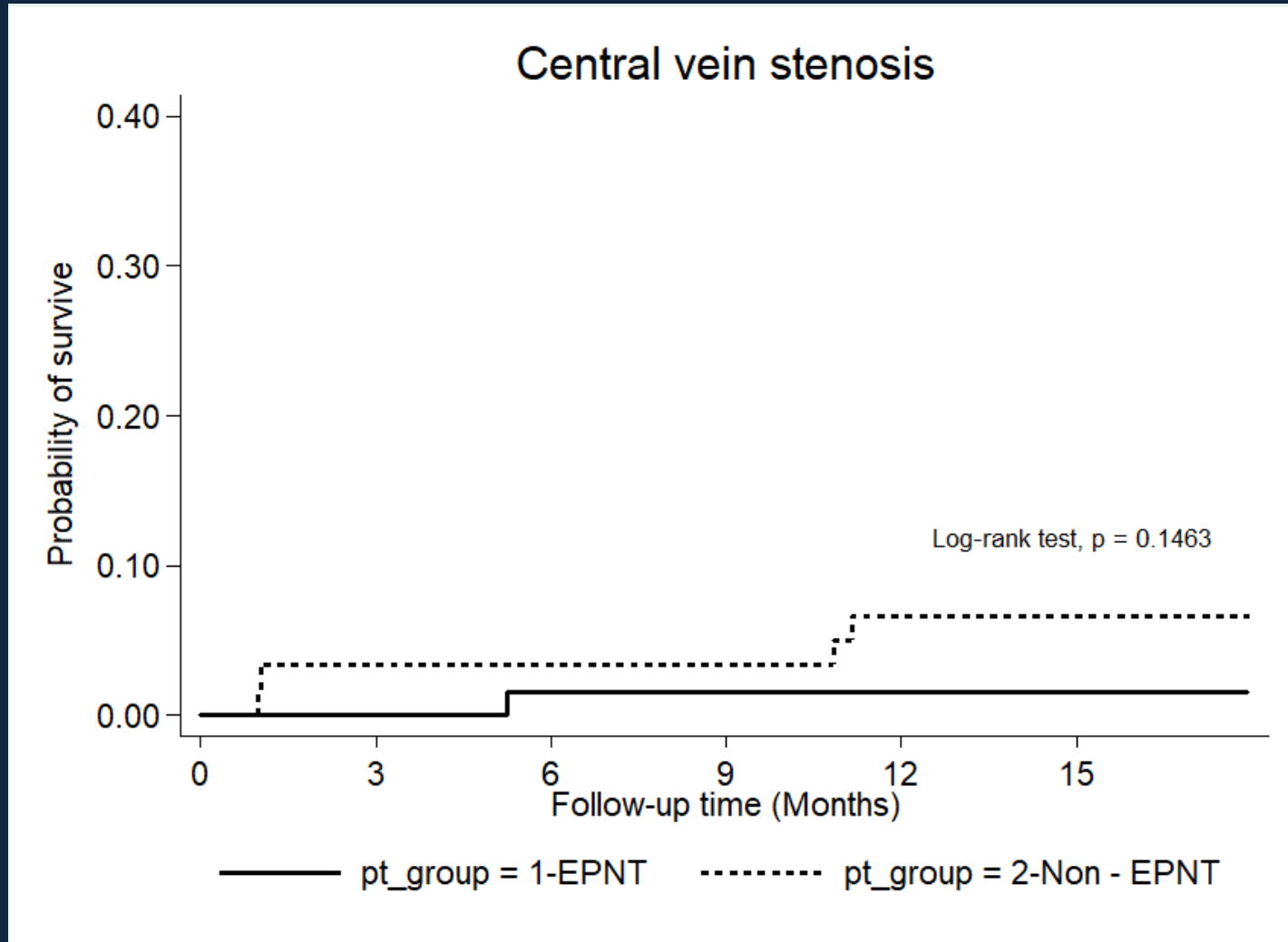
Kaplan-Meier curves show Maturation rate
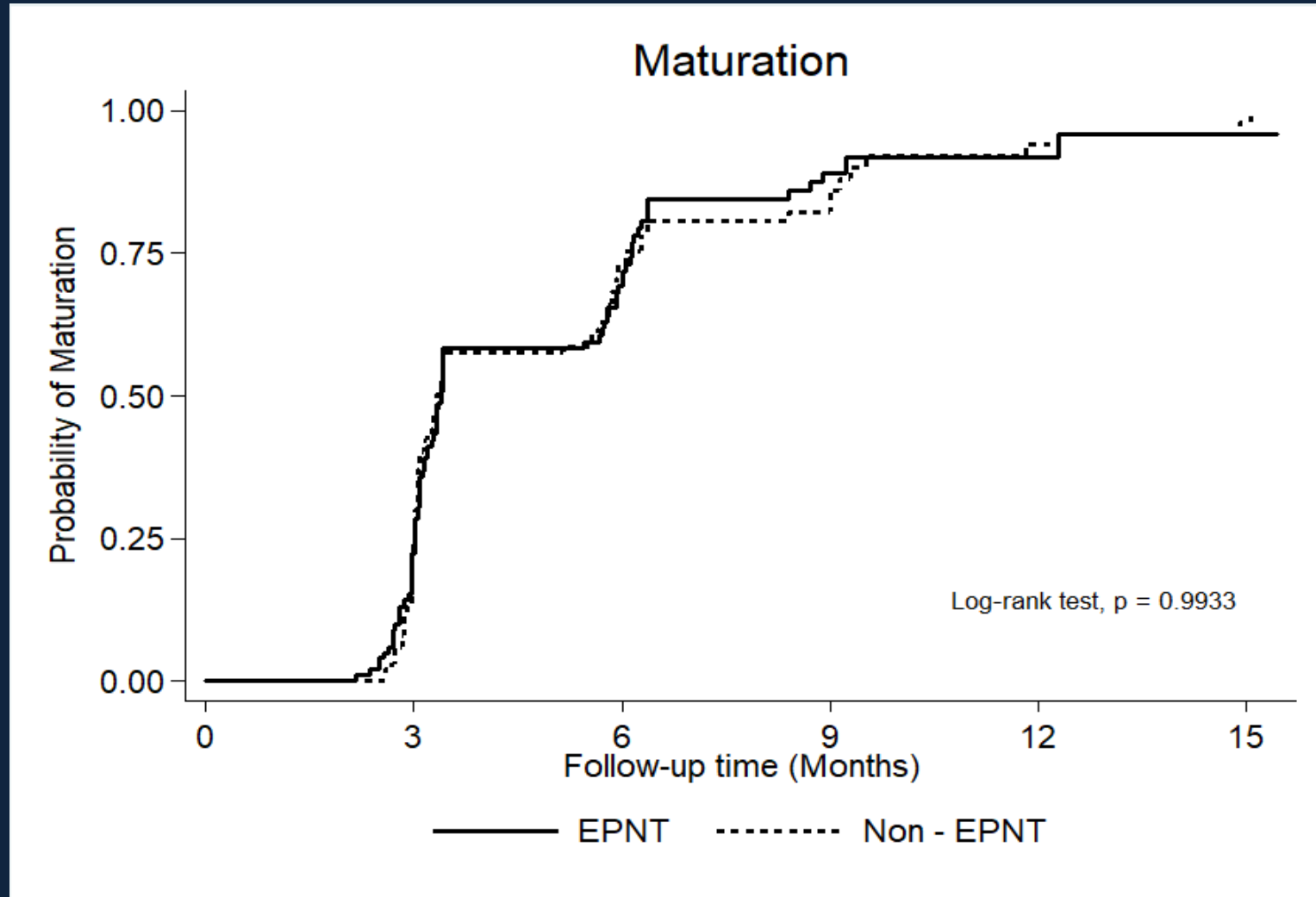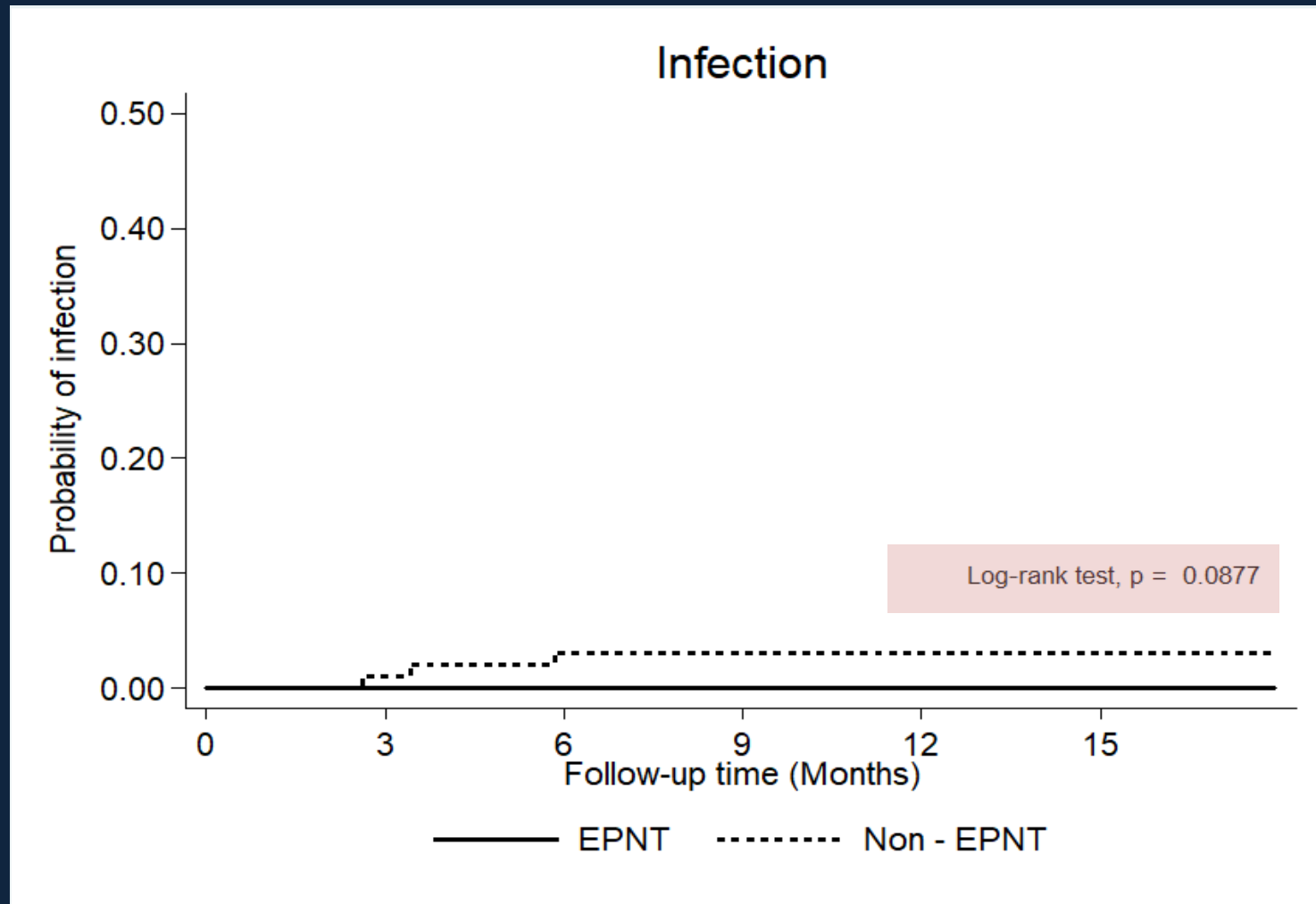
Rate of AVA complication each follow-up time
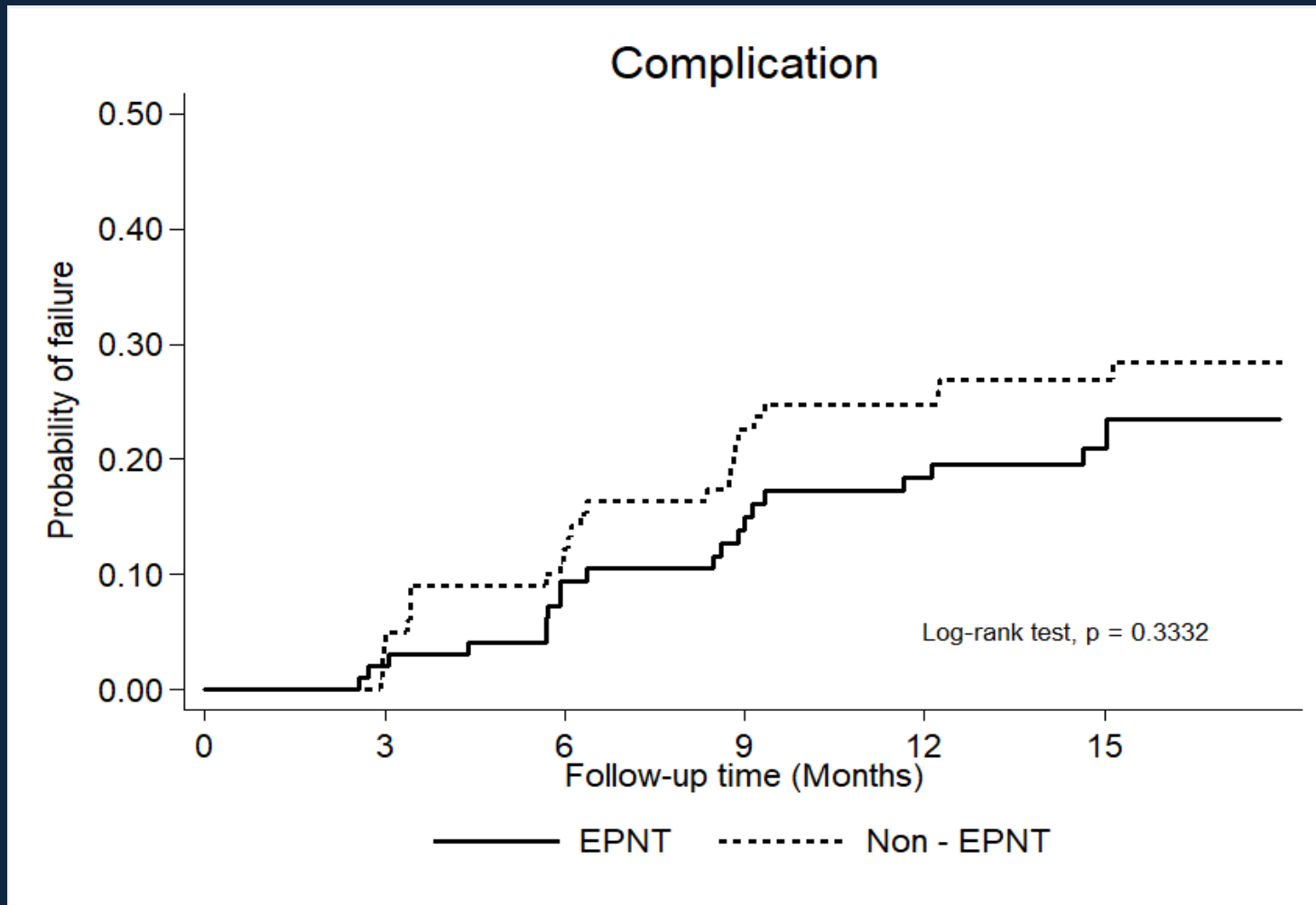
- Non EPNT group tend to be higher but not significant.

Rate of Central venous stenosis


- EPNT 1.23%
- Non-EPNT 5.11%
- p = 0.1463

Kaplan-Meier curves show incidence of sepsis rate


Infection

EPNT 0% and Non-EPNT 12.0%, p = 0.0877

Quality of life by SF36 at 1 year follow-up

| Transformed raw scale (0-100 scale)	Mon. 0		Mon. 6		Mon. 12	
	EPNT (N = 100)	Non-EPNT (N = 101)	EPNT (N = 91)	Non-EPNT (N = 96)	EPNT (N = 71)	Non-EPNT (N = 78)
Health transition item (HT)						
Mean ± SD	3.20 ± 1.02	2.70 ± 1.36	2.44 ± 0.93	2.17 ± 1.02	2.35 ± 1.07	2.15 ± 0.77
Median	3	3	3	2	2	2
Min. – Max.	1 – 5	1 – 5	1 – 5	1 – 5	1 – 5	1 – 3
p25 – p75	3 – 4	2 – 4	2 -3	1 – 3	2 -3	2 - 3
	$p = 0.0032$		$p = 0.0586$		$p = 0.4107$	
Physical Health **Physical functioning (PF)**						
Mean ± SD	67.90 ± 28.65	68.27 ± 32.57	75.66 ± 27.30	85.36 ± 18.12	75.07 ± 28.91	87.50 ± 18.53
Median	75	75	85	90	85	95
Min. – Max.	0 – 100	0 – 100	0 – 100	30 - 100	0 – 100	0 – 100
p25 – p75	50 – 95	50 - 100	65 - 100	80 - 100	55 - 95	80 - 100
	$p = 0.5435$		$p = 0.0248$		$p = 0.0022$	
Role limitations due to physical health (RP)						
Mean ± SD	71.94 ± 29.08	66.83 ± 32.48	71.91 ± 29.22	73.89 ± 22.19	75.26 ± 28.20	73.48 ± 24.03
Median	81.25	75	87.5	75	81.25	75
Min. – Max.	0 – 100	0 – 100	0 – 100	25 – 100	0 – 100	25 – 100
p25 – p75	50 - 100	43.75 – 100	50 - 100	53.12 – 93.75	62.5 - 100	50 - 100
	$p = 0.3196$		$p = 0.7717$		$p = 0.3346$	
Body pain (BP)						
Mean ± SD	99.80 ± 2.00	86.78 ± 16.20	96.48 ± 10.29	90.99 ± 15.58	97.58 ± 8.70	92.67 ± 13.50
Median	100	100	100	100	100	100
Min. – Max.	80 – 100	12 – 100	50 – 100	22 – 100	52 – 100	30 – 100
p25 – p75	100 - 100	74 - 100	100 - 100	80 - 100	100 - 100	84 - 100
	$p = 0.0000$		$p = 0.0051$		$p = 0.0018$	
General health perceptions (GH)						
Mean ± SD	50.66 ± 21.48	42.01 ± 19.33	54.57 ± 20.52	46.74 ± 19.82	57.84 ± 20.66	50.04 ± 16.35
Median	50	40	52	46	62	49.5
Min. – Max.	5 – 92	5 – 87	5 – 100	5 – 100	0 – 100	15 – 87
p25 – p75	40 - 65	30 - 52	37 - 72	31 - 57	45 - 72	37 - 62
	$p = 0.0018$		$p = 0.0033$		$p = 0.0046$	
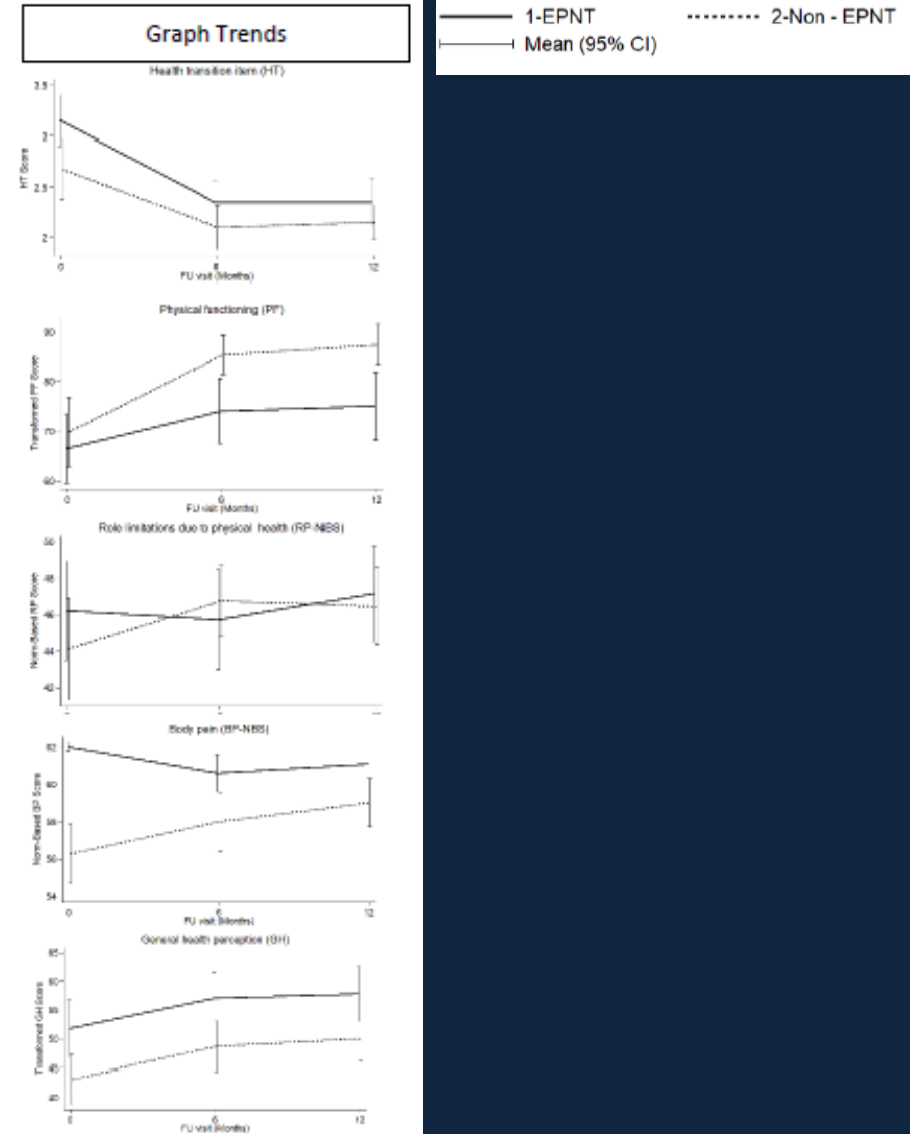
Graph Trends — 1-EPNT, 2-Non-EPNT, Mean (95% CI)

Quality of life by SF36 at 1 year follow-up

| Transformed raw scale (0-100 scale)	Mon. 0		Mon.6		Mon.12	
	EPNT (N = 100)	Non-EPNT (N = 101)	EPNT (N = 91)	Non-EPNT (N = 96)	EPNT (N = 71)	Non-EPNT (N = 78)
Mental Health **Vitality (energy/fatigue) (VT)**						
Mean ± SD	56.50 ± 19.54	53.84 ± 15.96	59.55 ± 22.19	55.21 ± 22.76	66.20 ± 23.06	63.78 ± 27.20
Median	50	50	50	50	75	53.12
Min. – Max.	18.75 – 100	6.25 – 100	25 – 100	25 – 100	18.75 – 100	25 – 100
p25 – p75	50 – 68.75	50 – 56.25	50 – 81.25	37.5 – 75	50 – 81.25	50 – 87.50
	$p = 0.1717$		$p = 0.1822$		$p = 0.8614$	
Social functioning (SF)						
Mean ± SD	90.62 ± 18.66	76.86 ± 27.41	95.05 ± 14.05	94.27 ± 12.16	94.19 ± 19.23	95.03 ± 10.34
Median	100	75	100	100	100	100
Min. – Max.	0 – 100	0 – 100	25 – 100	50 – 100	0 – 100	50 – 100
p25 – p75	87.5 - 100	75 - 100	100 - 100	100 - 100	100 - 100	100 -100
	$p = 0.0000$		$p = 0.3504$		$p = 0.2058$	
Role limitations due to emotional health (RE)						
Mean ± SD	75.83 ± 27.61	70.30 ± 28.37	75.27 ± 26.86	72.31 ± 22.64	82.28 ± 25.62	72.33 ± 23.16
Median	83.33	75	83.33	75	100	79.17
Min. – Max.	0 – 100	0 – 100	16.67 – 100	16.67 – 100	0 – 100	16.67 – 100
p25 – p75	50 – 100	50 – 91.67	50 - 100	58.33 – 91.67	66.67 - 100	50 – 91.67
	$p = 0.0744$		$p = 0.1544$		$p = 0.0010$	
General mental health (MH)						
Mean ± SD	70.65 ± 17.89	69.36 ± 16.43	72.97 ± 16.07	67.76 ± 15.15	79.37 ± 13.96	66.41 ± 12.64
Median	75	75	75	75	85	70
Min. – Max.	20 – 100	5 – 100	45 – 100	25 – 95	45 – 95	45 – 80
p25 – p75	60 - 85	60 - 80	60 - 90	55 - 80	75 - 90	55 - 75
	$p = 0.7960$		$p = 0.0318$		$p = 0.0000$	

Graph Trends
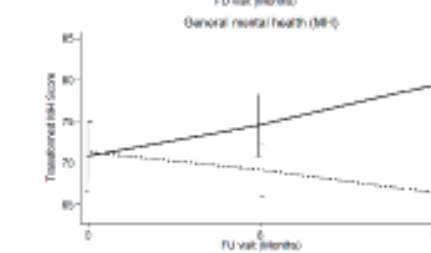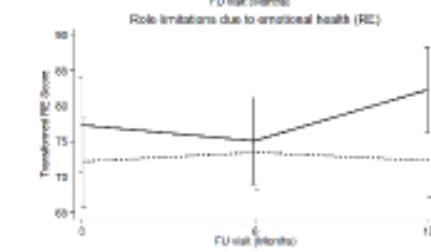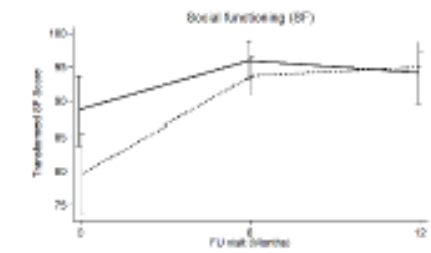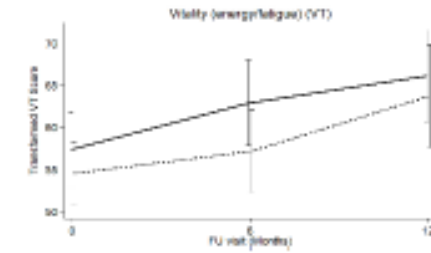
1-EPNT   2-Non - EPNT   Mean (95% CI)

General mental health at 1 year follow-up
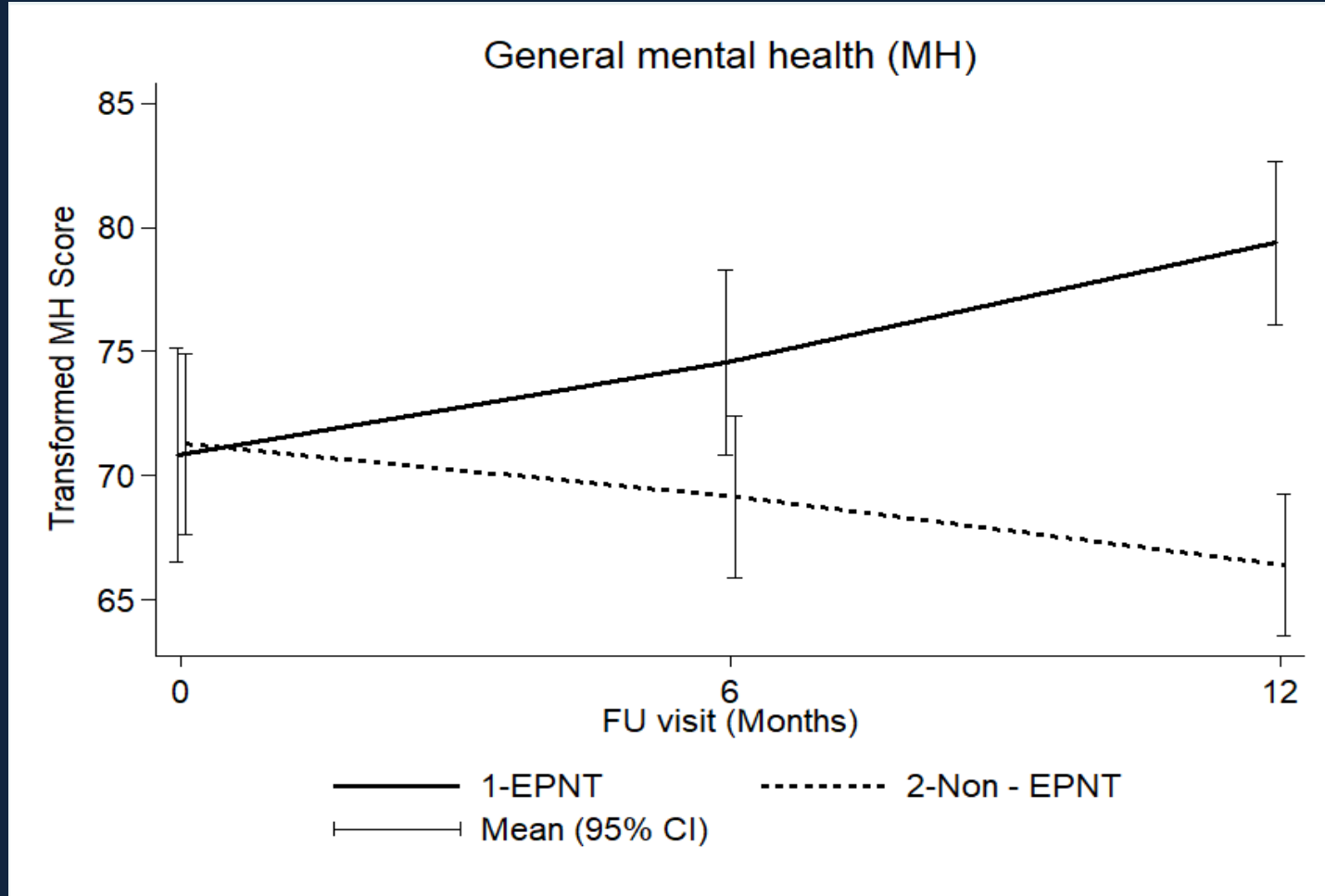
- EPNT group had significantly more score general mental health than non EPNT
- Perhaps this is due to
  - Pts have never had suffered from chronic retained dialysis catheter
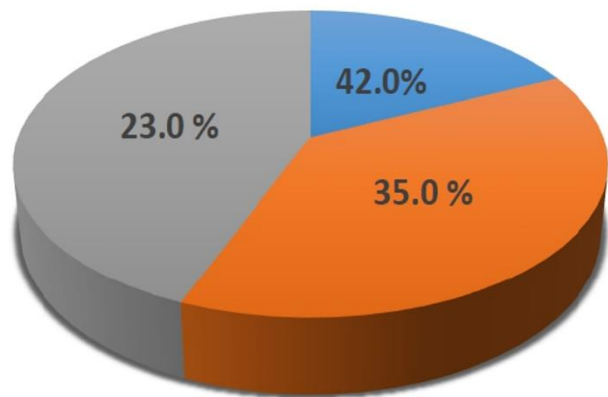 - revisiting hospital or longer hospitalization.

EPNT 3 Month

18% maturation, HD
38% maturation, not HD
44% not maturation, not HD
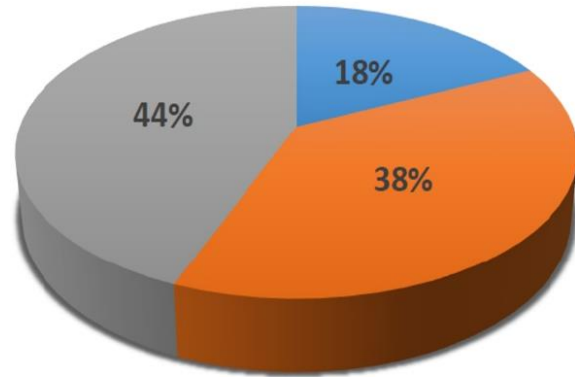
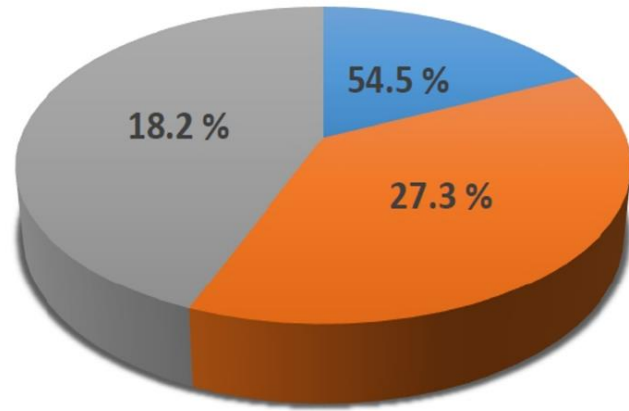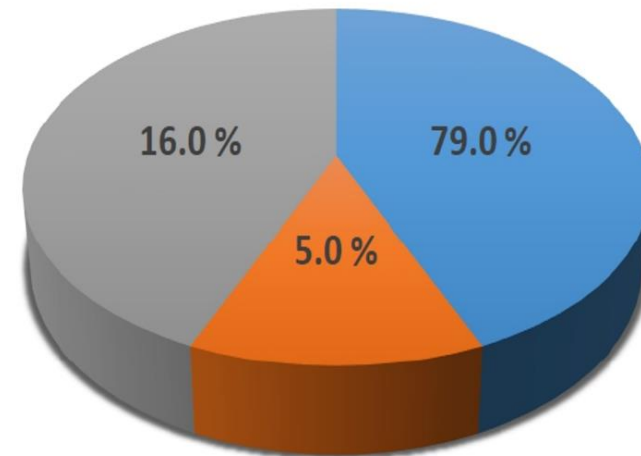■ maturation, HD   ■ maturation, not HD   ■ not maturation, not HD

Non EPNT 3 Month

43.6 % maturation, HD
12.8 % maturation, not HD
43.6 % not maturation, not HD
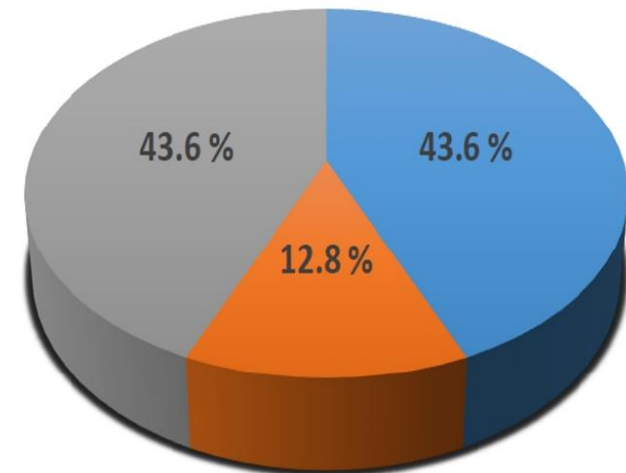
■ maturation, HD   ■ maturation, not HD   ■ not maturation, not HD

EPNT 6 Month

- 42.0%
- 35.0 %
- 23.0 %

■ maturation, HD ■ maturation, not HD ■ not maturation, not HD
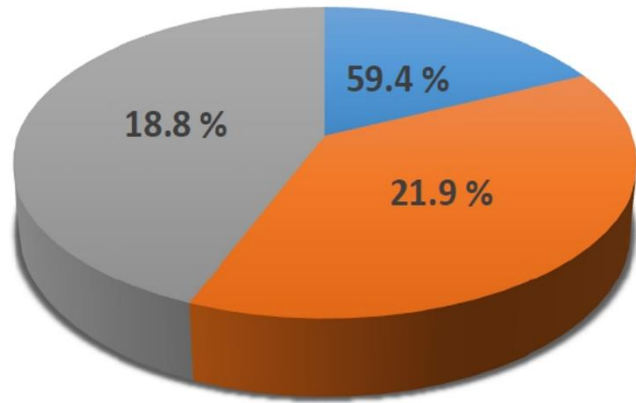

Non EPNT 6 Month

- 68.3 %
- 7.9 %
- 23.8 %
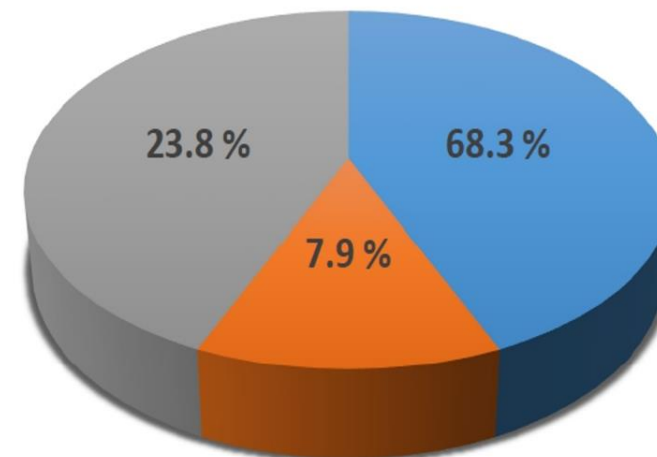
■ maturation, HD ■ maturation, not HD ■ not maturation, not HD

EPNT 12 Month

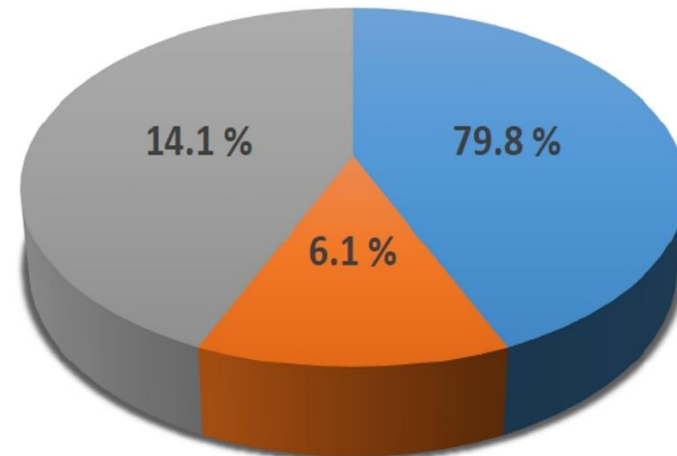| | maturation, HD | maturation, not HD | not maturation, not HD |

Non EPNT 12 Month

| | maturation, HD | maturation, not HD | not maturation, not HD |

EPNT 15 Month

59.4 %
21.9 %
18.8 %

■ maturation, HD ■ maturation, not HD ■ not maturation, not HD
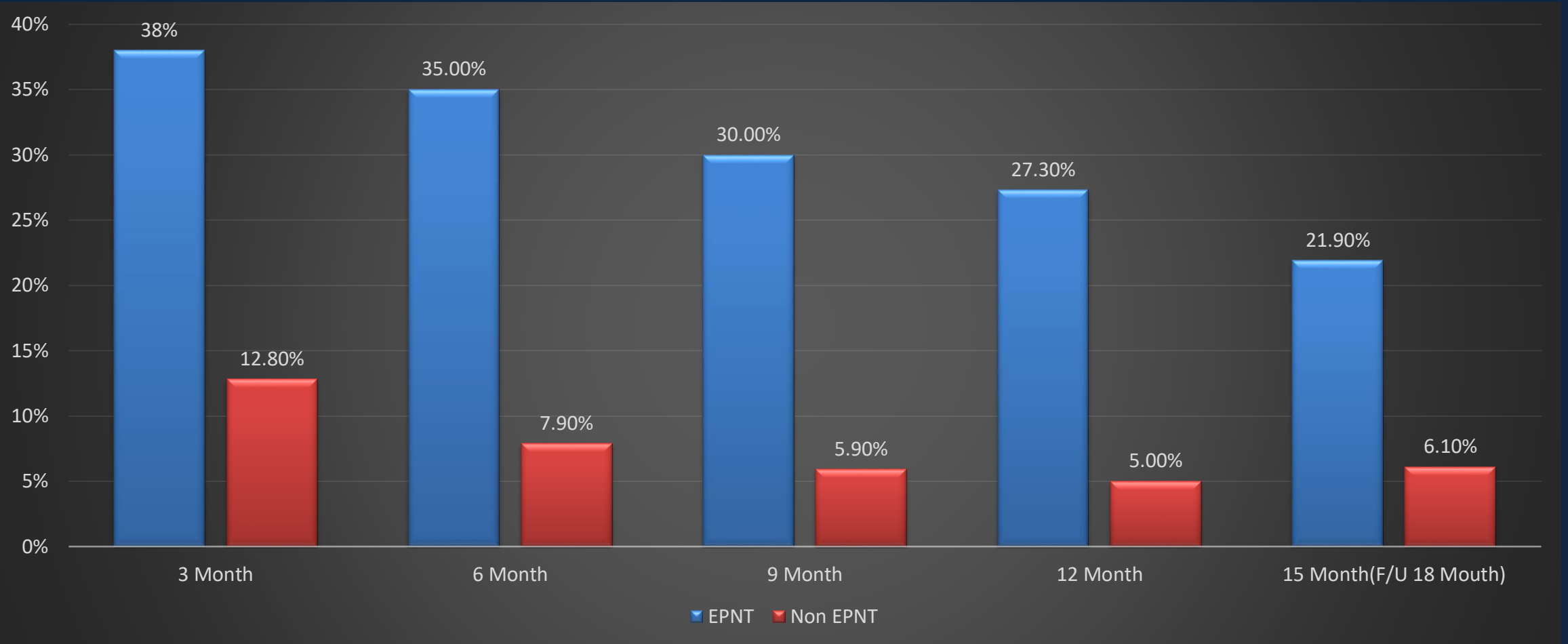

Non EPNT 15 Month

79.8 %
6.1 %
14.1 %

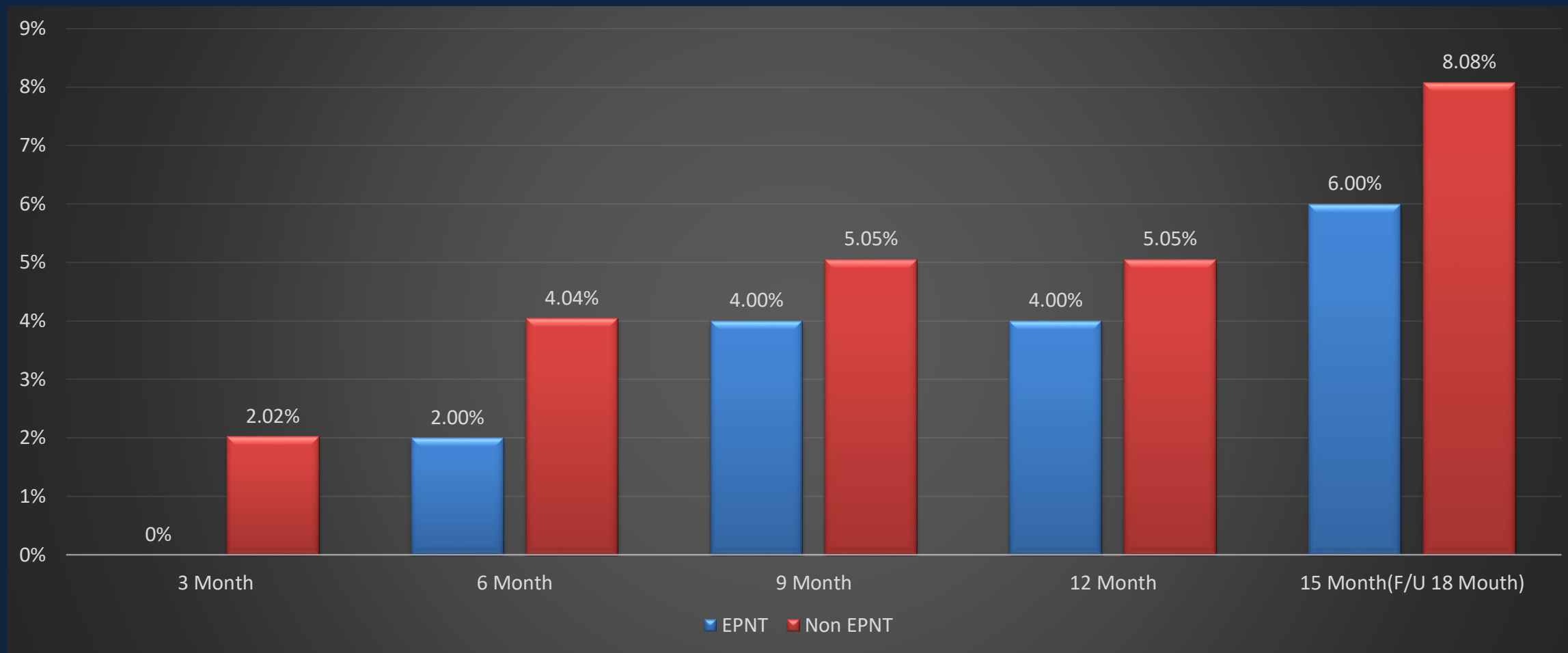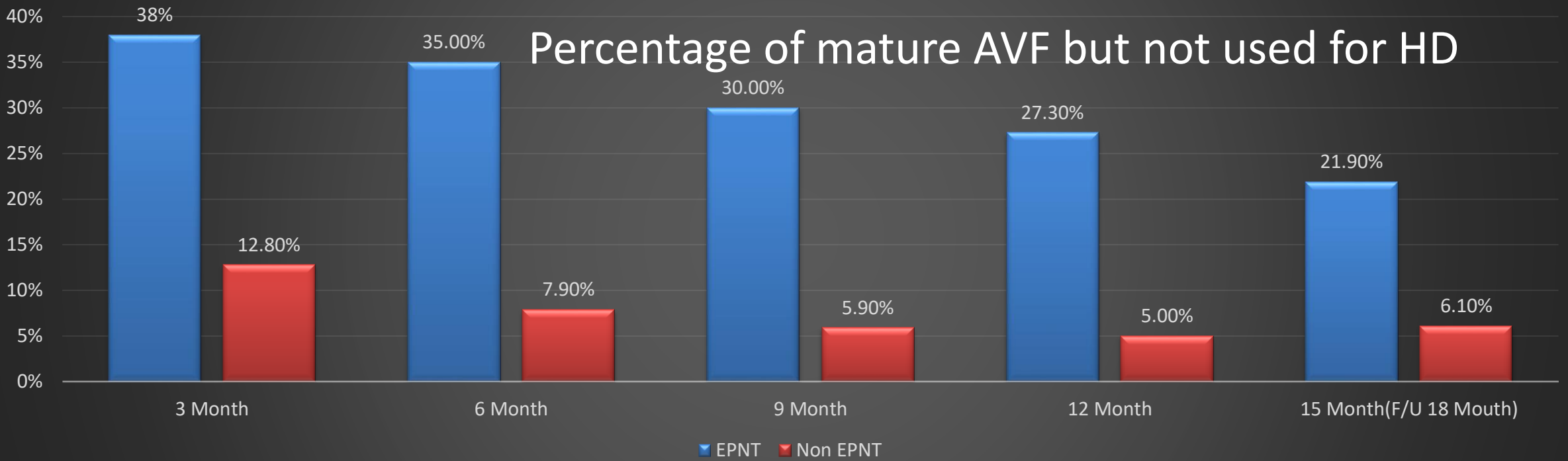■ maturation, HD ■ maturation, not HD ■ not maturation, not HD

The percentage of matured AVF but not used for HD

The percentage of mortality
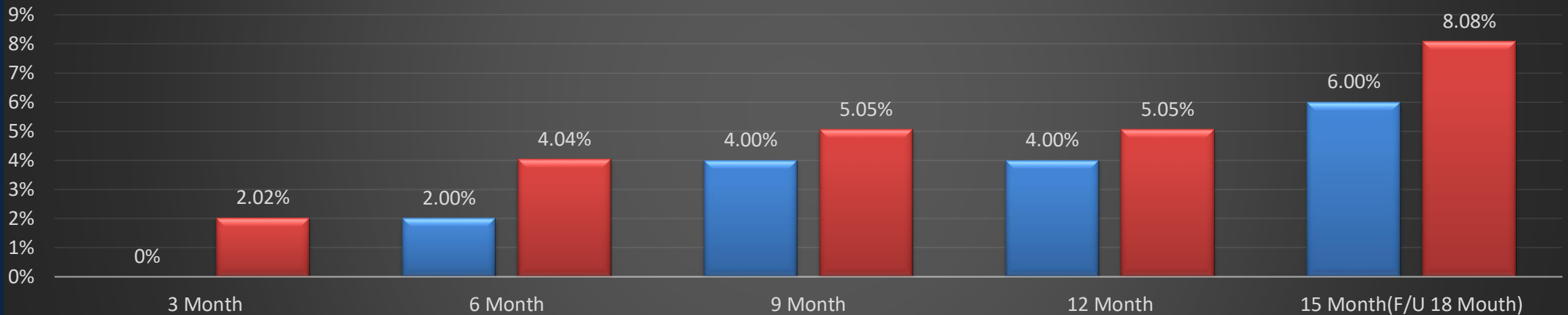
Percentage of mature AVF but not used for HD

	3 Month	6 Month	9 Month	12 Month	15 Month(F/U 18 Mouth)
EPNT	38%	35.00%	30.00%	27.30%	21.90%
Non EPNT	12.80%	7.90%	5.90%	5.00%	6.10%

Percentage of mortality

	3 Month	6 Month	9 Month	12 Month	15 Month(F/U 18 Mouth)
EPNT	0%	2.00%	4.00%	4.00%	6.00%
Non EPNT	2.02%	4.04%	5.05%	5.05%	8.08%

Summary

- Pre emptive approach

  + Less sepsis

  Better mental status

  - High rate of unused AVA for HD.
    How to avoid??

Tangri Score

Kidney Failure Risk Equation (4 Variable)

Estimate risk of progression to end-stage renal disease in CKD patients using age, sex, eGFR and proteinuria with KFRE

Sex?

Male
Female

Age?

Unanswered	Years ▼

eGFR?

Unanswered	mL/min/1.73m² ▼

Urine Albumin Creatinine Ratio? (Note units carefully)

Unanswered	mg/mmol ▼

Patient location?

North America
Non-North America

Tangri score

Kidney Failure Risk Equation (4 Variable)

Estimate risk of progression to end-stage renal disease in CKD patients using age, sex, eGFR and proteinuria with KFRE

Sex?

Male
Female

Age?

60	Years ▼

eGFR?

20	mL/min/1.73m² ▼

Urine Albumin Creatinine Ratio? (Note units carefully)

300	mg/mmol ▼

Patient location?

North America
Non-North America

Results

Risk of progression to kidney failure requiring dialysis or transplantation

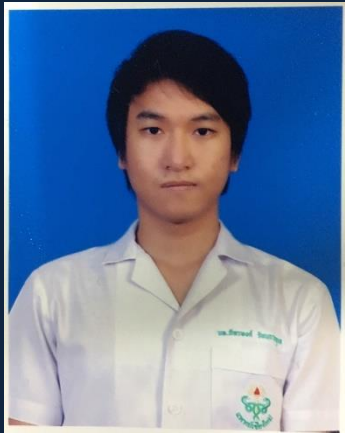| Over 2-Years: |
|---|
| **38.83%** |

Over 5-Years:
85.09%

For patients with CKD Stage 4, we consider a 2-year risk of kidney failure of 0-10 % as low risk, 10-20 % as intermediate risk and > 20 % as high risk

Co investigators

Nurses

Research assistant

Thank you

Participants, Researchers,

Funding bodies, 40 HD centers

Thank you

Thankyou

Specific AVA complication

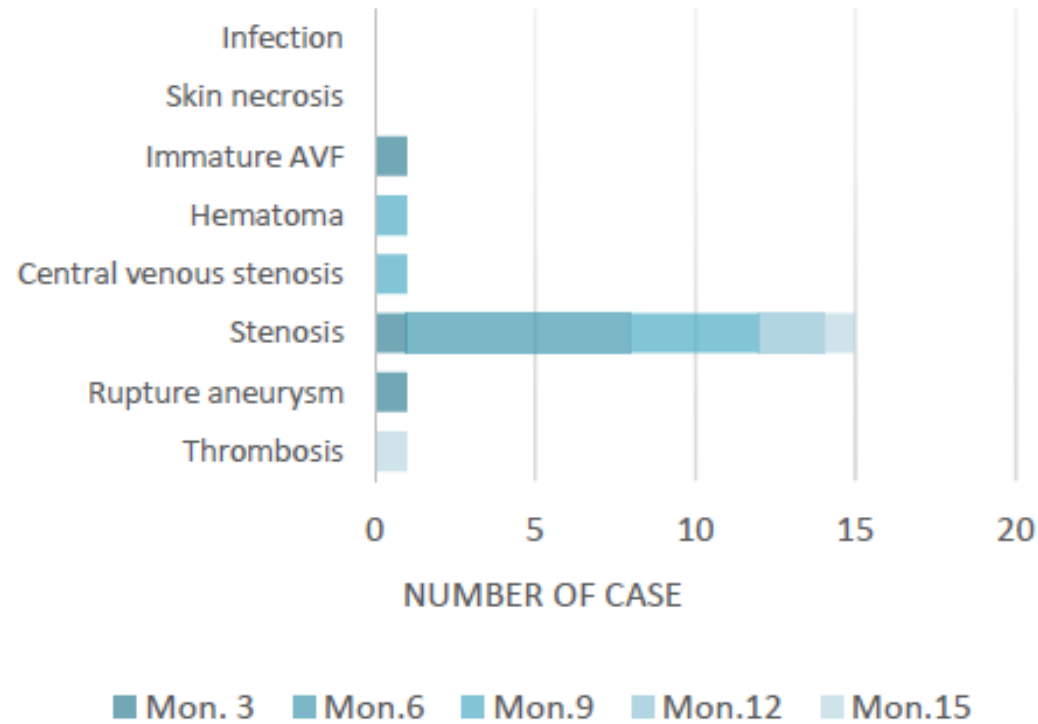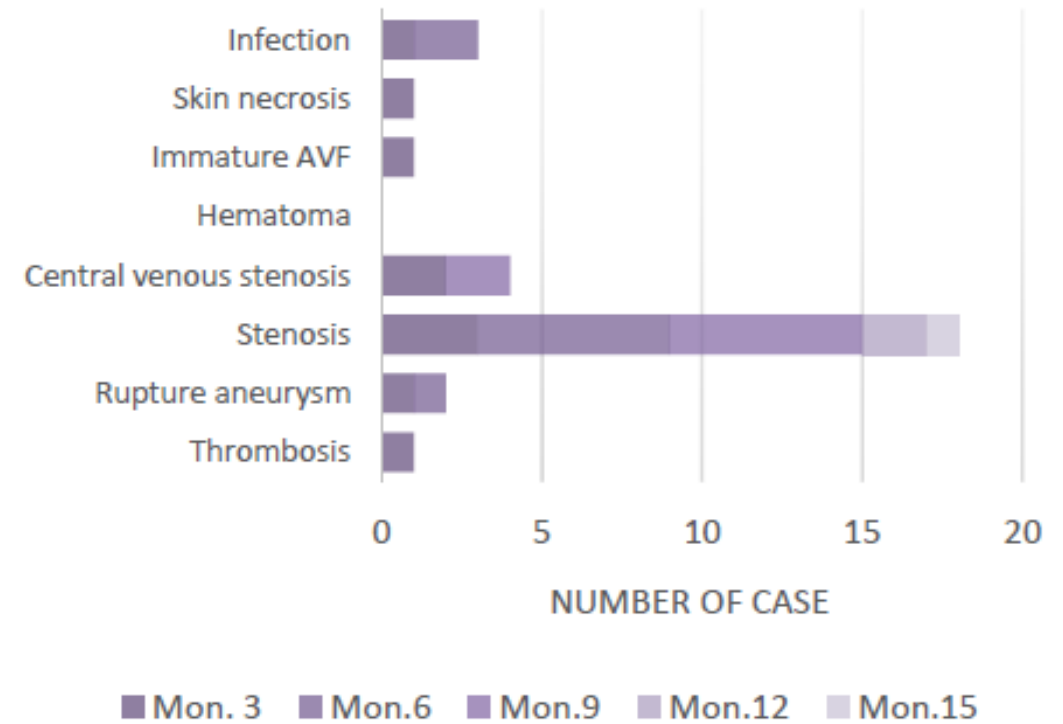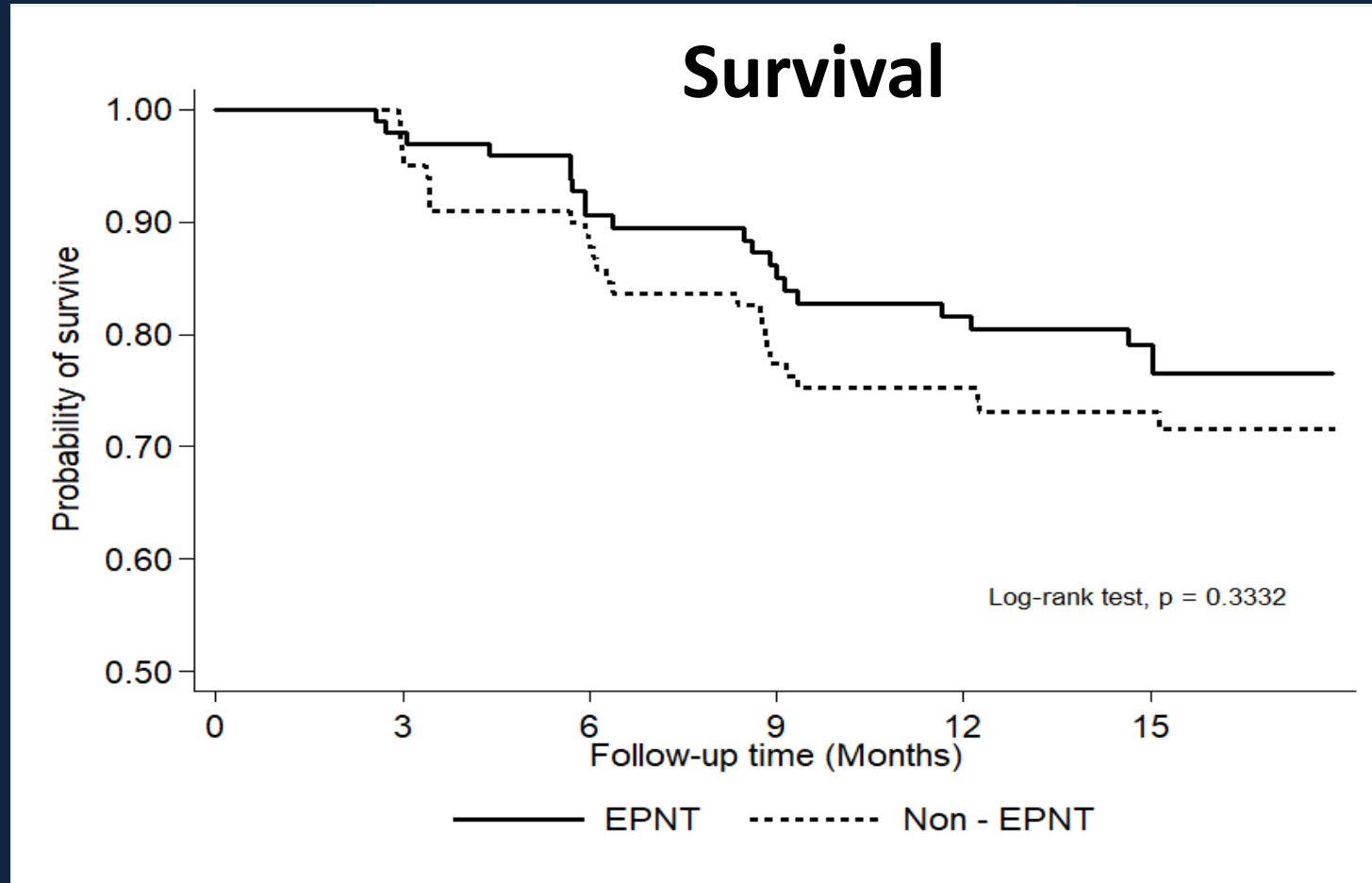FIGURE 2: SPECIFIC FIRST AVA COMPLICATION IN EPNT GROUP

FIGURE 3: SPECIFIC FIRST AVA COMPLICATION IN NON-EPNT GROUP
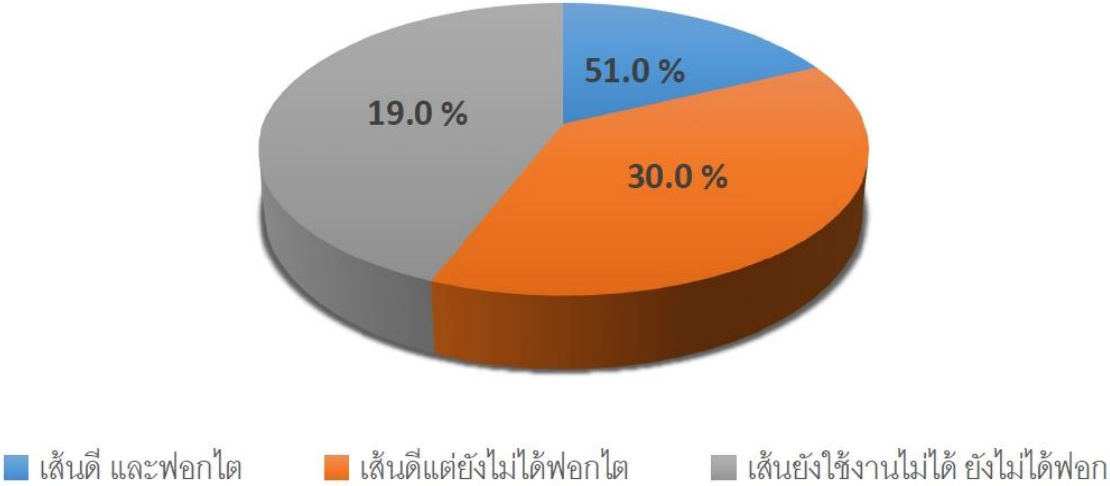
Discussion: AVA Survival at 15 month

Survival

- In our study the survival rate is not significantly (p=0.3332)
- EPNT : 79.04%
- Non-EPNT : 73.09%

Visit 4 Time 9 Month

	EPNT	Non EPNT	Total
เส้นดี และฟอกไต	51	77	128
	51.0 %	76.2 %	63.7 %
เส้นดีแต่ยังไม่ได้ฟอกไต (ค่าไตยังดีอยู่)	30	6	36
	30.0 %	5.9 %	17.9 %
เส้นยังใช้งานไม่ได้ ยังไม่ได้ฟอก	19	18	37
	19.0 %	17.8 %	18.4 %
Total	100	101	201
	100 %	100 %	100 %
ผู้ป่วยเสียชีวิต เส้นดับ terminate	19	20	39
	19.0 %	19.8 %	19.4 %