Renal function after endovascular abdominal aortic aneurysm repair

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Introduction

Endovascular aneurysm repair (EVAR) is the preferred treatment for abdominal aortic aneurysm (AAA) when anatomy is compatible. Acute kidney injury (AKI) is a common complication after EVAR. Long term renal function decreases after EVAR. AKI and long term renal function decline after EVAR are associated with cardiovascular morbidity and mortality.

Our primary end point was to assess incidence of AKI and mid term renal function decrease after EVAR. Secondary end points were to look for factors influencing renal function deterioration and to evaluate effect of renal function decrease on survival.

Materials & methods

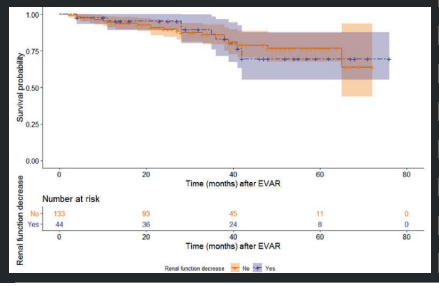
We reviewed retrospectively EVAR performed in our University Hospital between January 2014 and June 2019. Based on the Acute Kidney Injury Network (AKIN) and Risk, Injury, Failure, Loss, End-stage (RIFLE) staging systems, AKI was defined as increase in serum creatinine by ≥ 0,3 mg/dl within 48 hours. Based on CKD-EPI equation (Chronic Kidney Disease EPIdemiology collaboration), mid term renal function decline was defined as loss of estimated glomerular filtration rate (eGFR) ≥ 20%. 32 factors related to patients, procedure and follow up were screened.

For quantitative variables, data were summarized as mean and standard deviation (SD). Frequency tables (numbers and percentages) were used for categorical variables. Creatinine and eGFR evolution analyzed using Student test for paired observations. Logistic regression models were used to identify predicting factors for AKI and for renal function decrease. Survival after EVAR has been described using Kaplan Meier curves and Cox regression models were used to examine the impact of AKI and of renal function decrease on survival. Results were considered significant at the 5% critical level (p<0.05). The analyses were performed using SAS (version 9.4) and R (version 3.6) softwares.

Results

Renal function within 48 hours (N=185)		
Creatinine (mg/dl)	N (%)	Mean ± SD
Baseline	185	1.09 ± 0.312
Within 48 hours	185	1.15 ± 0.414
Evolution	185	0.0643 ± 0.241 p=0.0004
AKI	15 (8.1)	–
Stage 1	14	–
Stage 2	1	–
Stage 3	0	–

Mid term renal function evolution (N=177)		
	N (%)	Mean ± SD
Follow up (months)	177	31 ± 19
eGFR Baseline	177	68.3 ± 17.9
eGFR Last value	177	63.8 ± 21.6
Evolution	177	-4.6 ± 12.7 p<0.0001
Decrease ≥ 20 %	44 (24.9)	–



	Description		Factors influencing AKI					Factors influencing mid term renal function				
	N (%)	Mean ± SD	All (N=185)	AKI (N =15)	No AKI (N=170)	OR (95%CI)	p-value	All (N=177)	Renal function decline Yes (N =44)	Renal function decline No (N=133)	OR (95%CI)	p-value
Age (years)	190	74.0 ± 8.1	74.1 ± 8.1	74.5 ± 6.7	73.8 ± 8.1	1.04 (0.97-1.1)	0.23	74.1 ± 7.9	75.7 ± 7.6	73.6 ± 8.0	1.03 (0.99-1.1)	0.14
Men	171(90.0)	-	166 (89.7)	12 (80.0)	154 (90.6)	0.42 (0.11-1.6)	0.21	160 (90.4)	40 (90.9)	120 (90.2)	1.1 (0.33-3.5)	0.89
Tobacco	112 (58.9)	-	110 (59.5)	9 (60.0)	101 (59.4)	1.03 (0.35-3.0)	0.97	105 (59.3)	29 (65.9)	76 (57.1)	1.4 (0.71-2.9)	0.31
Hypertension	148 (77.9)	-	143 (77.3)	14 (93.3)	129 (75.9)	4.4 (0.57-35)	0.16	140 (79.1)	38 (86.4)	102 (76.7)	1.9 (0.74-5.0)	0.18
Diabetes	39 (20.5)	-	38 (20.5)	4 (26.7)	34 (20.0)	1.5 (0.44-4.9)	0.54	37 (20.9)	11 (25.0)	26 (19.6)	1.4 (0.61-3.1)	0.44
Dyslipidemia	142 (74.7)	-	140 (75.7)	14 (93.3)	126 (74.1)	4.9 (0.63-38)	0.13	135 (76.3)	34 (77.3)	101 (75.9)	1.1 (0.48-2.4)	0.86
CKD	55 (28.9)	-	52 (28.1)	10 (66.7)	42 (24.7)	6.1 (2.0-19)	0.0017	51 (28.8)	14 (31.8)	37 (27.8)	1.2 (0.58-2.5)	0.61
Renal artery stenosis	6 (3.2)	-	5 (2.7)	1 (6.7)	4 (2.3)	-	-	5 (2.8)	4 (9.1)	1 (0.8)	-	-
Cardiopathy	80 (42.1)	-	78 (42.2)	5 (33.3)	73 (42.9)	0.67 (0.22-2.0)	0.47	74 (41.8)	18 (40.9)	56 (42.1)	0.95 (0.48-1.9)	0.89
Stroke	31 (16.3)	-	31 (16.8)	2 (13.3)	29 (17.1)	0.75 (0.16-3.5)	0.71	29 (16.4)	9 (20.4)	20 (15.0)	1.4 (0.61-3.5)	0.40
PAD	27 (14.2)	-	27 (14.6)	2 (13.3)	25 (14.7)	0.89 (0.19-4.2)	0.89	25 (14.1)	4 (9.1)	21 (15.8)	0.53 (0.17-1.7)	0.28
Statin	118 (62.1)	-	116 (62.7)	10 (66.7)	106 (62.3)	1.2 (0.40-3.7)	0.74	112 (63.3)	27 (61.4)	85 (63.9)	0.90 (0.44-1.8)	0.76
CEI	66 (34.7)	-	64 (34.6)	6 (40.0)	58 (34.1)	1.3 (0.44-3.8)	0.65	61 (34.5)	17 (38.6)	44 (33.1)	1.3 (0.63-2.6)	0.50
Sartan	33 (17.4)	-	33 (17.8)	4 (26.7)	29 (17.1)	1.8 (0.53-5.9)	0.36	32 (18.1)	6 (13.6)	26 (19.6)	0.65 (0.25-1.7)	0.38
Metformin	28 (14.7)	-	27 (14.6)	2 (13.3)	25 (14.7)	0.89 (0.19-4.2)	0.89	26 (14.7)	10 (22.7)	16 (12.0)	2.2 (0.89-5.2)	0.087
Creatinine baseline	-	-	1.09 ± 0.312	1.35 ± 0.399	1.07 ± 0.293	11 (2.5-47)	0.0016	1.09 ± 0.304	1.16± 0.329	1.07 ± 0.294	2.5 (0.85-7.4)	0.094
eGFR baseline	-	-	68.6 ± 18.2	53.7 ± 22.1	69.9 ± 17.3	0.95 (0.92-0.98)	0.0019	68.3 ± 17.9	63.9 ± 17.4	69.8 ± 17.8	0.98 (0.96-1.001)	0.058
Neck thrombus	5 (2.6)	-	5 (2.7)	1 (6.7)	4 (2.3)	-	-	4 (2.3)	2 (4.6)	2 (1.5)	-	-
AAA diameter	189	58.6 ± 10.9	58.5 ± 11.0	62.4 ± 13.0	58.2 ± 10.7	1.03 (0.99-1.07)	0.16	58.5 ± 11.0	58.1 ± 11.1	58.6 ± 11.2	1.0 (0.97-1.03)	0.80
General anaesthesia	88 (46.3)		85 (46.0)	7 (46.7)	78 (45.9)	1.03 (0.36-3.0)	0.95	84 (47.5)	18 (40.9)	66 (49.6)	0.70 (0.35-1.4)	0.32
Contrast dosis (ml)	163	124.1 ± 52.5	124.9 ± 52.6	123.3 ± 52.4	142.5 ± 53.1	1.01 (0.99-1.02)	0.21	123.9 ± 52.4	123.6 ± 53.4	124.7 ± 50.0	1.00 (0.99-1.01)	0.91
Renal polar artery	15 (7.9)	-	14 (7.6)	2 (13.3)	12 (7.1)	2.0 (0.41-10)	0.39	14 (7.9)	3 (6.8)	11 (8.3)	0.81 (0.22-3.1)	0.76
Hypogastric embolization	25 (13.2)	-	25 (13.5)	2 (13.3)	23 (13.5)	0.98 (0.21-4.6)	0.98	23 (13.0)	6 (13.6)	17 (12.8)	1.1 (0.40-2.9)	0.88
Associated procedure	25 (13.2)	-	20 (10.8)	2 (13.3)	18 (10.6)	-	-	17 (9.7)	2 (13.4)	15 (9.43)	-	-
Per-op complications	9 (4.7)	-	9 (4.9)	1 (6.7)	8 (4.7)	-	-	9 (5.1)	1 (6.7)	8 (5.0)	-	-
Transfusion	1(0.5)	-	1 (0.5)	0 (0.0)	1 (0.6)	-	-	1 (0.6)	0 (0.0)	1 (0.8)	-	-
AKI (N=175)	-	-	-	-	-	-	-	15 (8.6)	9 (20.9)	6 (4.6)	5.6 (1.9-17)	0.0022
Endoleak	-	-	-	-	-	-	-	62 (35.0)	12 (27.3)	50 (37.6)	0.62 (0.29-1.3)	0.22
Number of angio CT ≥5	-	-	-	-	-	-	-	100 (56.5)	26 (59.1)	74 (55.6)	1.1 (0.58-2.3)	0.69
Reintervention	-	-	-	-	-	-	-	34 (19.2)	8 (18.2)	26 (19.6)	0.91 (0.38-2.2)	0.84

Conclusion

Incidence of AKI after EVAR was 8,1% and of mid term renal function deterioration was 24,9%.
The only predicting factor of AKI was CKD and the only of mid term renal function deterioration was AKI.
Renal function had no influence on the survival.

Potential new diagnostic markers of renal function decline, prevention modalities and therapeutic agents have to be evaluated and validated in prospective studies.

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No conflict of interest

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