

Supplementary Materials

Allergic lung inflammation aggravates angiotensin II-induced abdominal aortic aneurysms in mice

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Supplementary Tables

Supplementary Table I. Production of allergic lung inflammation (ALI) at the same time or before AAA formation enhanced AAA progression in *Apoe*^{-/-} mice.

Variable	ALI and AAA at the same time		P value	ALI first, then AAA		P value
	OVA (n=13)	Saline (n=11)		OVA (n=14)	Saline (n=12)	
Anthropometric parameters						
Body weight-beginning (g)	26.50±0.81	25.02±0.87	0.226	22.90±0.45	23.36±0.43	0.213
Body weight-end (g)	29.43±0.48	29.47±0.76	0.959	30.19±0.46	30.93±0.27	0.181
SBP-beginning (mmHg)	102.07±3.17	98.27±2.38	0.348	101.67±3.95	103.75±2.55	0.673
SBP-end (mmHg)	125.69±3.96	120.64±5.97	0.494	124.42±4.88	118.58±4.07	0.075
DBP-beginning (mmHg)	77.57±3.20	71.45±2.81	0.164	77.75±2.43	75.83±3.50	0.555
DBP-end (mmHg)	95.62±3.41	89.73±4.05	0.286	99.83±4.57	92.17±3.80	0.035
AAA lesion analysis						
AAA size (mm)	4.34±0.46	2.31±0.21	0.001	3.07±0.32	1.95±0.24	0.006
Mortality (%)	7.14%	8.33%	1.000	6.67%	0%	1.000
AAA incidence (%)	100%	100%	1.000	92%	100%	1.000
Area (mm ²)	1.67±0.28	0.69±0.23	0.036	1.09±0.11	0.51±0.05	0.033
Macrophage (%)	11.85±1.54	7.75±0.78	0.044	10.48±1.53	5.12±0.91	0.007
Mast cell (# per section)	24.42±3.84	9.89±1.32	0.011	14.75±2.27	4.27±1.29	<0.001
CD4 ⁺ T-cell (# per section)	34.00±4.93	30.45±4.94	0.673	35.67±8.08	24.27±8.99	0.368
CD8 ⁺ T-cell (# per section)	22.67±4.02	23.55±2.51	0.878	23.25±3.95	26.75±7.75	0.692
MHC-II (% area)	0.73±0.12	1.18±0.46	0.411	1.56±0.53	0.73±0.32	0.199
SMC loss (grade)	3.45±0.11	2.14±0.11	<0.001	2.35±0.11	1.94±0.09	0.010
Collagen (grade)	3.01±0.24	3.23±0.21	0.494	2.83±0.26	2.43±0.31	0.331
Elastin frag. (grade)	2.46±0.17	2.19±0.19	0.324	1.74±0.15	1.71±0.09	0.863
Ki67 ⁺ cell (# per section)	67.46±14.94	26.91±5.90	0.047	16.25±4.40	11.83±4.30	0.480
Microvessel (# per section)	76.33±13.83	14.91±4.35	0.004	19.00±5.20	12.33±5.88	0.405
TUNEL ⁺ cell (# per section)	85.50±9.96	75.73±13.36	0.609	64.00±4.05	65.09±9.80	0.922
Plasma lipid proteins						
Total cholesterol (mg/dL)	189.71±11.08	174.05±13.10	0.367	268.16±12.17	249.82±6.93	0.207
LDL (mg/dL)	73.38±20.01	112.44±45.32	0.427	50.85±13.42	69.66±14.08	0.344
HDL (mg/dL)	101.43±31.38	86.61±25.41	0.718	172.07±24.39	115.17±13.17	0.056
Triglyceride (mg/dL)	164.52±25.42	182.78±23.37	0.612	362.55±38.51	326.23±13.07	0.387
Plasma inflammatory proteins						
IgE (µg/mL)	0.93±0.14	0.35±0.09	0.004	0.92±0.11	0.42±0.08	0.001
IFN-γ (pg/mL)	75.60±12.04	57.05±8.76	0.328	1.78±1.63	16.21±6.98	0.139
TNF-α (pg/mL)	19.12±1.61	18.10±1.59	0.658	54.53±27.05	67.67±35.65	0.768
Eotaxin (pg/mL)	66.52±7.08	64.22±5.02	0.797	234.62±12.56	231.28±12.37	0.858
MCP-1 (pg/mL)	81.71±5.42	83.80±7.70	0.828	146.59±8.37	169.58±19.68	0.326
IL4 (pg/mL)	43.87±8.55	47.27±15.59	0.851	22.88±12.36	31.72±7.93	0.567
IL5 (pg/mL)	5.19±0.58	10.86±2.13	0.044	6.09±2.68	28.97±5.71	0.002
IL13 (pg/mL)	2.50±0.32	1.57±0.26	0.050	1.62±0.96	15.36±4.89	0.019
TGF-β (ng/mL)	7.03±0.72	6.44±0.85	0.605	3.28±0.96	6.80±1.29	0.050
BALF cell typing						
Total Cell in BALF (x10 ⁴)	52.75±7.30	15.71±7.05	0.031	5.94±1.60	3.54±0.59	0.147
Macrophage (%)	26.67±4.45	89.00±2.89	<0.001	75.42±5.55	96.00±0.51	0.018
Lymphocyte (%)	30.83±3.91	9.83±2.37	0.015	14.42±2.53	2.50±0.60	0.002
Eosinophil (%)	40.83±4.35	0.83±0.61	0.001	8.25±2.12	1.08±0.50	0.026
Neutrophil (%)	1.67±0.69	0.33±0.16	0.266	1.83±1.27	0.50±0.29	0.446
BALF proteins						
IgE (ng/mL)	214.11±28.22	142.30±34.31	0.138	84.01±11.32	107.97±12.24	0.164
IFN-γ (pg/mL)	11.27±1.66	12.39±3.21	0.766	7.45±1.17	6.73±1.87	0.750
TNF-α (pg/mL)	317.57±58.01	212.18±15.62	0.132	121.42±13.19	169.95±19.36	0.052
Eotaxin (pg/mL)	49.57±8.62	32.12±1.43	0.099	26.79±2.61	34.09±3.52	0.112
MCP-1 (pg/mL)	67.84±10.39	50.11±5.72	0.174	33.02±4.75	46.28±5.01	0.068
IL4 (pg/mL)	1.71±0.55	2.08±0.41	0.606	1.38±0.33	2.45±0.54	0.110
IL5 (pg/mL)	4.66±1.41	3.15±1.32	0.453	0.55±0.21	0.57±0.22	0.932
IL13 (pg/mL)	105.03±9.01	89.24±5.24	0.168	70.94±3.27	83.81±4.14	0.023
TGF-β (pg/mL)	100.49±34.93	40.27±18.58	0.168	108.88±21.45	85.56±19.56	0.431

Supplementary Table II. Production of allergic lung inflammation (ALI) after AAA formation enhanced AAA progression in *ApoE*^{-/-} mice.

Variable	ALI only		P value	AAA first, then ALI		P value
	OVA (n=8)	Saline (n=8)		OVA (n=10)	Saline (n=10)	
Anthropometric parameters						
Body weight-1 (g)	27.71±0.31	27.93±0.41	0.685	27.34±1.30	27.46±1.04	0.947
Body weight-2 (g)	32.64±0.41	32.19±0.81	0.631	32.83±0.97	32.10±0.63	0.536
SBP-1 (mmHg)	108.25±2.12	110.13±4.01	0.687	102.89±5.74	102.89±3.18	1.000
SBP-2 (mmHg)	108.38±2.38	109.63±3.47	0.772	146.25±9.39	137.11±7.23	0.471
DBP-1 (mmHg)	89.50±2.94	86.00±4.37	0.519	76.89±4.75	75.00±3.21	0.746
DBP-2 (mmHg)	89.00±2.70	88.25±3.44	0.866	110.13±8.41	97.33±6.97	0.278
AAA lesion analysis						
AAA size (mm)	1.00±0.05	1.03±0.05	0.727	2.71±0.42	1.49±0.14	0.020
Mortality (%)	0	0	1.000	28.57%	16.67%	0.562
AAA incidence (%)	0	0	N/A	80%	90%	0.999
Area (mm ²)	0.09±0.01	0.08±0.01	0.573	1.92±0.48	0.75±0.21	0.041
Macrophage (% area)	3.31±0.27	3.05±0.70	0.734	11.59±0.99	12.32±1.02	0.659
Mast cell (# per section)	0.75±0.53	1.25±0.75	0.594	61.00±11.93	16.33±4.30	0.012
CD4 ⁺ T-cell (# per section)	0.13±0.13	1.75±0.86	0.102	93.56±16.15	31.67±10.06	0.014
CD8 ⁺ T-cell (# per section)	0.00±0.00	0.38±0.08	0.083	54.78±7.34	18.33±7.99	0.010
MHC-II (% area)	0.04±0.01	0.12±0.05	0.321	1.15±0.17	1.42±0.41	0.553
SMC loss (grade)	1.1±0.01	1.2±0.01	0.999	3.09±0.10	1.97±0.18	<0.001
Collagen (grade)	1.70±0.58	3.42±0.15	0.020	1.56±0.13	2.97±0.22	<0.001
Elastin frag. (grade)	1.57±0.06	1.54±0.08	0.745	2.84±0.15	2.71±0.19	0.594
Ki67 ⁺ cell (# per section)	1.75±0.53	1.38±0.32	0.555	62.22±14.38	19.00±7.19	0.038
Microvessel (# per section)	1.25±0.65	2.00±0.41	0.356	58.89±18.24	24.22±9.55	0.159
TUNEL ⁺ cell (# per section)	1.75±0.80	3.13±1.11	0.332	92.78±10.88	61.22±3.17	0.038
Plasma lipid proteins						
Total cholesterol (mg/dL)	218.70±13.81	296.98±24.72	0.017	230.82±5.81	271.56±50.21	0.446
LDL (mg/dL)	181.56±52.64	168.96±31.49	0.846	95.41±21.62	153.09±40.13	0.232
HDL (mg/dL)	84.68±38.71	86.22±21.94	0.974	106.58±30.94	86.72±25.82	0.630
Triglyceride (mg/dL)	190.56±26.16	288.54±34.42	0.040	198.63±15.56	158.75±11.08	0.057
Plasma inflammatory proteins						
IgE (µg/mL)	0.40±0.07	0.05±0.01	0.006	0.49±0.09	0.35±0.07	0.309
IFN-γ (pg/mL)	17.37±3.15	7.00±2.45	0.022	94.51±18.45	85.55±14.32	0.753
TNF-α (pg/mL)	12.44±8.66	5.95±3.93	0.511	37.59±7.82	18.23±2.04	0.043
Eotaxin (pg/mL)	20.62±1.15	22.57±3.03	0.686	67.06±13.83	50.42±5.59	0.198
MCP-1 (pg/mL)	75.40±9.61	114.45±31.66	0.278	96.03±7.76	77.91±6.83	0.102
IL4 (pg/mL)	54.37±9.26	39.62±8.97	0.272	14.62±7.59	15.55±6.36	0.926
IL5 (pg/mL)	24.64±6.54	4.17±1.36	0.033	7.37±0.83	6.53±0.94	0.514
IL13 (pg/mL)	4.85±0.80	7.71±1.16	0.144	2.44±0.76	1.50±0.26	0.282
TGF-β (ng/mL)	1.57±1.01	1.10±1.07	0.753	2.83±1.02	5.40±0.42	0.045
BALF cell typing						
Total Cell in BALF (x10 ⁴)	12.15±1.22	6.42±0.76	0.002	36.72±6.76	9.58±3.04	0.003
Macrophage (%)	26.25±4.20	96.25±1.45	<0.001	27.22±6.76	78.89±3.61	<0.001
Lymphocyte (%)	22.50±3.27	3.13±1.17	<0.001	20.56±3.86	16.67±3.44	0.462
Eosinophil (%)	51.25±4.50	0.63±0.62	<0.001	51.67±6.97	3.33±1.44	<0.001
Neutrophil (%)	0.00±0.00	0.00±0.00	N/A	0.56±0.56	1.11±0.73	0.556
BALF proteins						
IgE (ng/mL)	35.08±6.78	12.32±1.26	0.011	33.82±8.22	38.44±6.95	0.674
IFN-γ (pg/mL)	321.33±55.28	303.71±65.10	0.839	231.01±59.56	277.98±43.84	0.552
TNF-α (pg/mL)	394.77±77.52	163.89±21.45	0.020	400.58±79.12	483.02±62.33	0.436
Eotaxin (pg/mL)	37.43±2.64	29.81±0.88	0.054	32.21±1.45	35.52±1.53	0.136
MCP-1 (pg/mL)	28.05±5.58	5.09±1.39	0.004	23.54±4.29	34.51±12.35	0.448
IL4 (pg/mL)	6.59±1.53	4.78±2.48	0.544	4.63±1.85	2.72±0.87	0.372
IL5 (pg/mL)	7.79±1.53	1.66±0.35	0.004	2.41±0.29	2.20±0.38	0.682
IL13 (pg/mL)	33.72±5.31	14.65±3.81	0.029	27.16±5.18	30.64±5.31	0.644
TGF-β (pg/mL)	343.93±35.51	395.02±48.26	0.409	206.41±29.83	201.79±26.44	0.912

Supplementary Table III. Contribution of AAA development on allergic lung inflammation (ALI) in *Apoe*^{-/-} mice.

Variable	OVA		P value	Saline		P value
	ALI only (n=8)	AAA first, then ALI (n=10)		ALI only (n=8)	AAA first, then ALI (n=10)	
Anthropometric parameters						
Body weight-1 (g)	27.71±0.31	27.34±1.30	0.789	27.93±0.41	27.46±1.04	0.683
Body weight-2 (g)	32.64±0.41	32.83±0.97	0.855	32.19±0.81	32.10±0.63	0.933
SBP-1 (mmHg)	108.25±2.12	102.89±5.74	0.401	110.13±4.01	102.89±3.18	0.180
SBP-2 (mmHg)	108.38±2.38	146.25±9.39	0.006	109.63±3.47	137.11±7.23	0.005
DBP-1 (mmHg)	89.50±2.94	76.89±4.75	0.042	86.00±4.37	75.00±3.21	0.063
DBP-2 (mmHg)	89.00±2.70	110.13±8.41	0.052	88.25±3.44	97.33±6.97	0.266
AAA lesion analysis						
AAA size (mm)	1.00±0.05	2.71±0.42	0.003	1.03±0.05	1.49±0.14	0.009
Mortality (%)	0	28.57%	0.254	0	16.67%	0.495
Area (mm ²)	0.09±0.01	1.92±0.48	0.001	0.08±0.01	0.75±0.21	0.011
Macrophage (% area)	3.31±0.27	11.59±0.99	<0.001	3.05±0.70	12.32±1.02	<0.001
Mast cell (# per section)	0.75±0.53	61.00±11.93	<0.001	1.25±0.75	16.33±4.30	<0.001
CD4 ⁺ T-cell (# per section)	0.13±0.13	93.56±16.15	<0.001	1.75±0.86	31.67±10.06	<0.001
CD8 ⁺ T-cell (# per section)	0.00±0.00	54.78±7.34	<0.001	0.38±0.08	18.33±7.99	<0.001
MHC-II (% area)	0.04±0.01	1.15±0.17	<0.001	0.12±0.05	1.42±0.41	0.009
SMC loss (grade)	1.1±0.01	3.09±0.10	<0.001	1.2±0.01	1.97±0.18	<0.001
Collagen (grade)	1.70±0.58	1.56±0.13	0.815	3.42±0.15	2.97±0.22	0.112
Elastin frag. (grade)	1.57±0.06	2.84±0.15	<0.001	1.54±0.08	2.71±0.19	<0.001
Ki67 ⁺ cell (# per section)	1.75±0.53	62.22±14.38	<0.001	1.38±0.32	19.00±7.19	<0.001
Microvessel (# per section)	1.25±0.65	58.89±18.24	<0.001	2.00±0.41	24.22±9.55	<0.001
TUNEL ⁺ cell (# per section)	1.75±0.80	92.78±10.88	<0.001	3.13±1.11	61.22±3.17	<0.001
Plasma lipid proteins						
Total cholesterol (mg/dL)	218.70±13.81	230.82±5.81	0.394	296.98±24.72	271.56±50.21	0.659
LDL (mg/dL)	181.56±52.64	95.41±21.62	0.185	168.96±31.49	153.09±40.13	0.756
HDL (mg/dL)	84.68±38.71	106.58±30.94	0.678	86.22±21.94	86.72±25.82	0.988
Triglyceride (mg/dL)	190.56±26.16	198.63±15.56	0.796	288.54±34.42	158.75±11.08	0.006
Plasma inflammatory proteins						
IgE (µg/mL)	0.40±0.07	0.49±0.09	0.483	0.05±0.01	0.35±0.07	0.007
IFN-γ (pg/mL)	17.37±3.15	94.51±18.45	0.011	7.00±2.45	85.55±14.32	0.001
TNF-α (pg/mL)	12.44±8.66	37.59±7.82	0.397	5.95±3.93	18.23±2.04	0.004
Eotaxin (pg/mL)	20.62±1.15	67.06±13.83	0.015	22.57±3.03	50.42±5.59	0.003
MCP-1 (pg/mL)	75.40±9.61	96.03±7.76	0.142	114.45±31.66	77.91±6.83	0.298
IL4 (pg/mL)	54.37±9.26	14.62±7.59	0.005	39.62±8.97	15.55±6.36	0.047
IL5 (pg/mL)	24.64±6.54	7.37±0.83	0.048	4.17±1.36	6.53±0.94	0.181
IL13 (pg/mL)	4.85±0.80	2.44±0.76	0.072	7.71±1.16	1.50±0.26	0.012
TGF-β (ng/mL)	1.57±1.01	2.83±1.02	0.049	1.10±1.07	5.40±0.42	0.018
BALF cell typing						
Total Cell in BALF (x10 ⁴)	12.15±1.22	36.72±6.76	0.006	6.42±0.76	9.58±3.04	0.339
Macrophage (x10 ⁴)	3.16±0.54	9.41±1.64	0.004	6.19±0.75	7.89±2.69	0.557
Lymphocyte (x10 ⁴)	2.84±0.61	6.50±0.84	0.003	0.20±0.08	1.34±0.44	0.032
Eosinophil (x10 ⁴)	6.25±0.88	20.70±5.50	0.030	0.03±0.03	0.16±0.07	0.122
Neutrophil (x10 ⁴)	0.00±0.00	0.11±0.11	0.346	0.00±0.00	0.19±0.15	0.251
BALF proteins						
IgE (ng/mL)	35.08±6.78	33.82±8.22	0.907	12.32±1.26	38.44±6.95	0.005
IFN-γ (pg/mL)	321.33±55.28	231.01±59.56	0.300	303.71±65.10	277.98±43.84	0.748
TNF-α (pg/mL)	394.77±77.52	400.58±79.12	0.958	163.89±21.45	483.02±62.33	0.001
Eotaxin (pg/mL)	37.43±2.64	32.21±1.45	0.111	29.81±0.88	35.52±1.53	0.006
MCP-1 (pg/mL)	28.05±5.58	23.54±4.29	0.533	5.09±1.39	34.51±12.35	0.060
IL4 (pg/mL)	6.59±1.53	4.63±1.85	0.426	4.78±2.48	2.72±0.87	0.455
IL5 (pg/mL)	7.79±1.53	2.41±0.29	0.009	1.66±0.35	2.20±0.38	0.310
IL13 (pg/mL)	33.72±5.31	27.16±5.18	0.448	14.65±3.81	30.64±5.31	0.028
TGF-β (pg/mL)	343.93±35.51	206.41±29.83	0.011	395.02±48.26	201.79±26.44	0.004