

Effect of Age and Sex on Left Atrial Morphology and Function

Thesis

***Submitted for Partial Fulfillment of Master Degree in
Cardiology***

By

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List of Abbreviations

- **A2C:** Apical two chamber.
- **A4C:** Apical four chamber.
- **AE %:** Active emptying volume percentage of total left atrial emptying volume
- **AF:** Atrial fibrillation.
- **AP:** Anteroposterior.
- **AQ:** Acoustic quantification.
- **BSA:** Body surface area.
- **CT:** Computed tomographic.
- **2D:** Two dimensional.
- **2DSTE:** Two dimensional speckle tracking echocardiography.
- **3D:** Three dimensional.
- **DT:** Deceleration time.
- **EF:** Ejection fraction.
- **Emp Vol:** Emptying volume.
- **Frac:** Fraction.
- **HR:** Heart rate.
- **LAA:** Left atrial appendage.
- **LAD:** Left atrial diameter.
- **LAV max:** Left atrial maximum volume.
- **LAV min:** Left atrial minimum volume.

- **LAV pre-a:** Left atrial pre-contraction volume.
- **LAWV:** Left atrial wall velocity.
- **Long D:** Longitudinal diameter.
- **LV:** Left ventricle.
- **LVED:** Left ventricular end-diastolic volume.
- **LVES:** Left ventricular end-systolic volume.
- **LVSV:** Left ventricular stroke volume.
- **MRI:** Magnetic resonance imaging.
- **MSCT:** Multi-slices computed tomographic.
- **PE%:** Passive emptying volume percentage of total left atrial emptying volume.
- **PVs:** Pulmonary veins.
- **TEE:** Transoesophageal echocardiography.
- **Trans D:** Transverse diameter.
- **TTE:** Transthoracic echocardiography.
- **VOL:** Volume.
- **VOL_{max}:** Maximal left atrial volume.
- **VOL_{min}:** Minimal left atrial volume.
- **VOL_P:** Pre-atrial contraction volume.

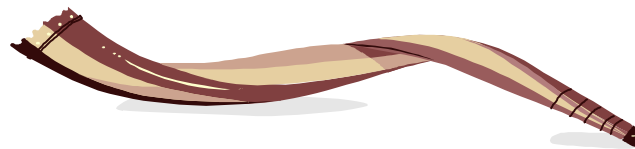
Acknowledgement

*First of all, I wish to express my sincere thanks to **Allah** for his care and generosity throughout of my life.*

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Last but not least, I am very grateful to the volunteers for their cooperation and I deeply hope best of health for them and to all those who loved or helped me.



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Dedication

To My lovely family

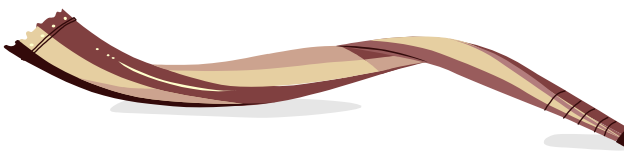
My Father, My Mother, My Sisters, and My Brothers, I dedicate this work to them, as my great happiness in theirs.

Sometimes, the truest feelings are those we keep inside, and though not often mentioned, they are the most sincere.

To My Great Mother, who has been standing by me in all means throughout my whole life, and offered me unconditional love and support, I would like to tell her that, words stand short when coming to express my deep love and gratitude for her.

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Patient number	age	sex	Wt (kg)	Ht (cm)	BSA (m ²)	HR (bpm)	B.p mmHg	E velocity (m/s)	A velocity (m/s)	E/A ratio	DT (ms)	Long Para-sternal			Short para-sternal LAD
												LAD	LVEDD	LVESD	
1	32	♂	100	180	2.24	80	125/80	0.753	0.512	1.47	210	2.76	4.84	3.8	2.9
2	35	♂	85	178	2	74	130/80	0.685	0.41	1.67	190	3.04	4.06	3.3	3.18
3	36	♂	65	175	1.78	78	120/80	0.71	0.443	1.6	210	2.9	5.2	3.9	2.8
4	65	♀	80	173	1.96	68	110/70	0.615	0.735	0.84	250	2.8	5.2	3.7	3.5
5	38	♀	90	178	2.11	70	130/70	0.825	0.45	1.83	210	2.9	4.5	3.7	2.8
6	33	♀	70	168	1.8	70	120/80	0.788	0.51	1.55	200	3.2	4.9	3.8	2.8
7	80	♂	78	180	1.97	68	140/80	0.535	0.71	0.754	260	3.4	4.8	3.7	4.2
8	75	♂	67	168	1.76	70	130/90	0.585	0.635	0.92	240	2.9	5.2	4.2	3.8
9	38	♂	95	178	2.17	65	120/70	0.815	0.626	1.3	220	3.2	4.9	3.2	2.9
10	30	♂	80	178	1.98	74	110/70	0.715	0.522	1.37	210	2.9	3.9	4.	3
11	56	♀	85	160	1.94	72	120/80	0.686	0.615	1.11	260	2.6	4.8	3.9	2.8
12	49	♂	78	180	1.97	68	130/85	0.638	0.55	1.16	200	3.6	5.2	4	3.7
13	36	♀	67	163	1.69	80	120/80	0.82	0.535	1.53	190	2.04	4.6	3.2	3.12
14	56	♀	90	160	2	70	130/80	0.636	0.710	0.896	220	2.8	5.6	4.5	2.8
15	35	♀	68	160	1.74	68	120/70	0.776	0.585	1.33	210	2.9	5.3	3.8	3.2
16	67	♀	100	165	2.14	65	130/90	0.678	0.715	0.95	240	2.29	5	3.36	2.85
17	67	♀	52	155	1.45	60	110/70	0.637	0.595	1.07	240	2.6	4.5	3.6	3.78
18	46	♂	67	165	1.75	80	120/80	0.825	0.631	1.3	210	2.9	4.8	4.1	2.9
19	40	♂	78	178	1.94	70	120/80	0.823	0.583	1.41	200	2.8	5.2	3.3	3.18
20	32	♂	85	180	2.06	85	120/80	0.86	0.515	1.67	210	3.04	4.7	3.31	3.8
21	58	♀	85	160	1.94	68	120/70	0.735	0.625	1.18	230	3.2	4.3	4.2	2.9
22	30	♂	67	183	1.85	70	110/70	0.861	0.533	1.62	198	3.1	4.9	3.9	2.8
23	39	♂	95	180	2.18	78	130/90	0.824	0.546	1.5	190	3	5.2	3.7	2.8
24	35	♀	55	162	1.57	75	120/80	0.683	0.575	1.19	220	2.7	5.3	3.5	3.2
25	65	♂	63	160	1.67	62	140/90	0.715	0.865	1.04	230	2.9	4.6	3.2	2.8

Patient number	Apical 4 chamber vi110ew					Apical 2 chamber view					Vol Max (ml)	Indexed Vol max (ml/m ²)	Vol P (ml)	Indexed Vol p (ml/m ²)	Vol Min (ml)	Indexed Vol min (ml/m ²)
	Long.D	Trans. D	Area max	Area p	Area min	Long.D	Trans. D	Area max	Area P	Area Min						
1	3.5	2.66	12.7	9.5	9.2	3.5	2.66	12.7	9.2	7.3	41.02	18.31	27.69	12.36	17.87	7.28
2	4.5	3.31	16.9	12.5	10.4	4.5	3.31	16.9	12.5	10.8	55.4	27.2	33.14	16.57	22.73	11.37
3	3.87	2.94	16.2	12.6	6.2	3.87	2.94	16.2	12.6	8.29	47.15	26.49	25.54	14.35	13.24	7.44
4	4.5	3.5	16.6	14.2	7.83	4.5	3.5	16.6	14.2	8.87	44.84	22.88	32.72	16.69	13.12	6.69
5	4.6	3.5	15.5	12.2	10.8	4.6	3.5	15.5	12.2	10.6	52.2	24.74	28.94	13.72	22.63	10.73
6	4.3	3.2	16.6	12	9.3	4.5	3.2	16.6	12	8.87	46.92	26.07	28.32	15.68	16.3	9.06
7	4.5	3.3	16.6	14.4	8.83	4.8	3.3	16.6	14.4	7.83	44.84	24.16	32.37	17.4	13.12	7.05
8	4.8	3.6	16.5	13.3	10.8	4.9	3.6	16.5	13.3	9.8	47.69	27.09	32.66	18.56	19.99	11.36
9	4.9	3.5	16	12.5	10.8	4.6	3.5	16	12.5	9.5	54.05	24.9	32.69	15.06	22.36	10.3
10	3.9	3	14.6	11.2	8.8	4.4	3	14.6	11.5	9	42.25	21.34	24.93	12.59	16.03	8.095
11	4.6	3.2	16	13	10	4.6	3.2	16	13	10.3	49.22	25.37	34.73	17.9	20.85	10.75
12	4.4	3.8	13.9	11.6	7.82	4.2	3.8	16	11.6	9.73	43.46	22.08	27.87	14.15	14.06	7.14
13	4.6	2.9	14.5	11.8	8.8	4.3	2.9	14.5	11.8	9	46.38	27.44	27.78	16.44	17.72	10.49
14	4.2	2.7	16.5	14.2	10.9	4.6	2.7	16.5	14.2	12.8	55.45	27.73	41.54	20.77	27.58	13.79
15	4.3	3.6	14	11.6	8.9	4.2	3.6	14	11.6	8.3	37.4	21.49	22.54	12.95	14.95	8.59
16	4.6	2.9	15.2	12.8	10.5	3.9	2.9	15.2	12.8	11	51	23.83	38.65	18.06	25.84	12.07
17	4.2	2.5	11.5	10.8	8.16	4.9	2.5	11.5	10.8	7.6	33.13	22.85	33.46	16.18	14.64	10.096
18	3.7	3.1	15.3	11.6	9.62	4.6	3.1	15.3	11.6	7.97	39.83	22.76	23.62	13.49	13.49	7.708
19	4.9	2.4	14	12.4	8.9	4.4	2.4	14	12.4	10	45.9	23.66	27.6	14.23	18.02	9.29
20	4.6	3.32	17	12.5	10.4	5	3.32	17	12.5	10.8	57	27.67	32.89	15.97	22.73	11.03
21	4.5	3.3	18.2	15.2	12.5	4.3	3.3	18.2	15.2	10.2	56.83	29.29	37.44	19.3	22.16	11.42
22	5	2.8	14.2	11.6	8.9	4.7	2.8	14.2	11.6	8.5	42.53	22.98	22.54	12.18	15.3	8.27
23	4.3	2.8	17.2	13.8	11.2	4.2	2.8	17.2	13.8	10.8	54.16	24.84	36.52	16.75	23.37	10.72
24	4.7	3.2	16.5	13.2	10	3.9	3.2	16.5	13.2	10.4	52.41	33.38	34.84	22.19	23.33	14.86
25	4.2	2.7	11	9.3	6.78	4.6	2.7	11	9.3	7.2	28.05	16.8	19.94	11.94	11.86	7.1

Patient number	Passive Emp. VOL	Indexed Passive Emp. vol	Active Emp. VOL	Indexed Active Emp. vol	LA total Emp. vol	Indexed LA Total Emp. vol	Conduit vol	Indexed Conduit vol	Passive Emp Fraction	Active Emp. fraction	LA Expansion Index (%)	LA total Emp. Fraction
1	13.33	5.95	9.82	4.38	23.15	10.33	37.85	16.89	32.5	35.46	129.55	56
2	22.26	11.13	10.41	5.2	32.67	16.34	48.13	24.07	40.18	31.41	143.73	58.97
3	21.61	12.14	12.3	6.9	33.91	19.05	28.09	15.78	45.83	48.16	256	71.9
4	12.12	6.18	19.6	10	31.72	16.18	36.81	18.78	27.03	59.9	241.77	70.74
5	23.26	11.02	6.31	3	29.57	14.01	35.93	17.03	44.6	21.8	130.68	56.64
6	18.69	10.38	11.93	6.63	30.62	17.02	34.08	18.93	41.6	42.62	187.85	65.26
7	12.47	6.32	19.25	9.77	31.72	16.1	26.28	13.34	27.8	59.47	241.77	70.74
8	15.03	8.54	12.68	7.2	27.7	15.74	47	26.7	31.5	38.79	136.07	58.08
9	21.36	9.84	10.33	4.76	31.69	14.6	50.81	23.41	39.5	31.6	141.73	58.5
10	17.32	8.75	8.9	4.5	26.22	13.24	57.87	29.18	41	35.69	163.57	62.06
11	14.49	7.47	13.88	7.15	28.37	14.62	31.43	16.2	29.45	39.97	136.07	57.64
12	15.59	7.9	13.81	7.01	29.4	14.92	40.06	20.76	35.87	49.56	209.1	67.65
13	18.6	11	10.06	5.95	28.66	16.96	31.84	18.84	40.1	36.2	161.74	61.79
14	13.91	6.96	13.96	6.98	27.87	13.94	36.33	18.17	25.08	33.6	101.05	50.26
15	14.86	8.54	7.59	4.36	22.45	12.9	39.75	22.84	39.73	33.67	150.17	60.
16	12.35	5.77	12.81	5.96	25.16	11.76	33.79	15.79	24.22	33.14	97.37	49.33
17	9.66	6.67	8.82	6.08	18.67	12.88	48.93	33.75	29.18	37.6	127.5	56.35
18	16.21	9.26	10.13	5.79	26.34	15.08	38.16	21.8	40.69	42.89	195.26	66.13
19	18.3	9.43	9.58	4.94	27.88	14.37	40.92	21.09	39.87	34.71	154.72	60.74
20	24.11	11.7	10.16	4.93	34.27	16.64	29.73	14.53	42.29	30.89	150.77	60.12
21	19.39	9.99	15.28	7.88	34.67	17.87	30.03	15.48	34.12	40.81	156.45	61
22	19.99	10.80	7.24	3.9	27.23	14.72	36.07	19.5	47	32.12	177.97	64.03
23	17.64	8.09	13.15	6.03	30.69	14.12	29.71	13.63	32.57	36	131.75	56.85
24	17.67	11.25	11.51	7.33	29.08	18.52	33.62	21.41	33.52	33.04	124.46	55.49
25	8.11	4.86	8.08	4.82	16.19	9.69	50.91	30.49	28.91	40.52	136.5	57.72

Patient number	PE %	AE %	Total vol/ LV SV %	Active vol/ LV SV%	EF (%)	LVED VOL	Indexed LVED VOL	LVES VOL	Indexed LVES VOL
1	57.58	42.4	37.95	16.09	60.39	101	45.09	40	17.87
2	68.14	31.86	40.43	12.88	60	134.5	67.25	53.7	26.85
3	63.73	36.27	54.69	19.83	58.5	107	60.11	45	25.28
4	28.3	61.79	46.29	28.6	57.8	120	61.22	51.47	26.25
5	78.66	21.34	45.15	9.63	58	116	54.98	50.5	23.93
6	60.45	38.96	47.33	18.44	62.8	103	57.22	38.3	21.28
7	39.31	60.69	54.69	33.18	64.5	98	49.75	40	20.3
8	54.26	466.58	37.08	16.96	60	125.5	71.3	50.7	28.8
9	67.4	32.59	38.41	12.52	59.5	143	65.89	60.5	27.88
10	66.06	33.94	31.21	10.59	59.15	142	71.7	58	29.29
11	51.07	48.92	47.44	23.2	61	98.5	50.77	38.8	19.95
12	53.03	46.97	42	19.73	60.69	116.5	59.14	45.8	23.25
13	64.89	35.1	47.37	16.63	63.15	95.8	56.69	35.3	20.89
14	49.9	50	43.4	21.75	63	101.7	50.85	37.5	18.75
15	66.19	33.8	36.09	12.2	62.2	100	57.47	37.8	21.72
16	49.08	50.92	42.68	21.73	59	102.8	48.04	42.6	19.9
17	51.78	47.25	27.61	13.05	65.76	102.8	70.9	35.2	24.28
18	61.54	38.46	40.84	15.7	59	109.3	62.46	44.8	25.6
19	65.64	34.36	40.52	13.92	59.5	115.6	59.59	46.8	25.64
20	70.35	29.65	53.55	15.88	62.5	98	49.75	40	20.3
21	55.93	44.07	53.59	23.62	65.69	98.5	50.77	33.8	14.72
22	73.4	26.59	43.02	11.44	63.43	99.8	53.95	36.5	19.73
23	57.33	42.7	50.89	21.73	61.55	98.3	45.09	37.8	17.34
24	60.76	39.58	46.38	18.36	63.65	98.5	62.74	35.8	22.8
25	50.09	49.9	24.13	12.04	64.64	103.8	62.16	36.7	21.98