

Significance of Body Mass Index In Relation To Renal Dimensions by Using Ultrasonography- A Clinical Study

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Abstract: *Objective: The Present Study Is A Sincere Effort On Morphometric Study Of Kidney In Healthy Subjects Using Various Parameters (Length, Width, Cortical Thickness, Renal Size And Renal Volume) Of Right And Left Kidneys In Normal Subjects Without Any Known Renal Diseases In Relation To Height, Weight, And Body Mass Index. Design & Setting: The Ultrasonographic Measurement Of Kidneys Were Taken In 67 Healthy Persons Aged 15-80 Years And Screened For Renal Dimensions In Healthy Subjects In The Department Of Radiology At Sri Venkateswara Institute Of Medical Sciences And Hospital, Tirupati. Comparative Analysis Of Mean Values Of All Renal Parameters Between Right And Left Kidney, Males And Females, And With Age, Height, Weight And Bmi Of The Subject Are Done By Means Of T-Test And Difference Among The Two Groups Are Considered To Be Significant If $P < 0.05$. Results: In General, Considering The Available Data It Is Observed That All The Parameters Are Relatively More In Males Than Females, And The Data Analysis Reveal That All The Parameters Are More In Relation To The Left Kidney Than The Right One. Conclusion: The Ultrasonography Method Forms Important Tool For Investigating Renal Pathologies And For Which The Normal Renal Data Of Various Parameters Is Necessary.*

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I. Introduction

The Present Study Of Kidney By Ultrasonography Method Is Most Relevant In Establishing The Various Parameters Of Kidneys Playing A Vital Role In Understanding Technical Complexities Of Modern Treatment. Renal Ultrasound Is A Valuable Non-Invasive Technique That Is Indicated To Assess Renal Size And To Investigate The Victims Of Renal Impairment.¹ The Present Study Is A Sincere Effort On Morphometric Study Of Kidney In Healthy Subjects Using Various Parameters (Length, Width, Cortical Thickness, Renal Size And Renal Volume) Of Right And Left Kidneys In Normal Subjects Without Any Known Renal Diseases In Relation To Height, Weight, And Body Mass Index. Such Study May Find A Place To Correlate The Difference Between Normal Functioning Kidney And The Diseased Kidney.

II. Methods

The Ultrasonographic Measurement Of Kidneys Were Taken In 67 Healthy Persons Aged 15-80 Years And Screened For Renal Dimensions In Healthy Subjects In The Department Of Radiology At Sri Venkateswara Institute Of Medical Sciences And Hospital, Tirupati. Ethical Clearance Was Obtained From The Institutional Review Committee Of Svims, Tirupati. These Subjects Were Screened For Detailed Clinical History And Performing Physical Examination To Exclude Clinical Conditions Like Hypertension, Diabetes, Renal Cyst, Renal Calculi, Acute And Chronic Kidney Diseases, Etc., After Taking Proper Consent. The Sonographic Measurements Of The Kidneys Were Collected From Real Time Ultrasound Images. All Ultrasonographic Assessments Were Carried Out By Radiologist Trained In Ultrasonography. Subjects Selected Were Evaluated Sonographically For Any Other Pathology Unrelated To Kidney's Position And Echo Texture To Qualify For Inclusion In The Study. In This Study Subject's Demographic Data Such As Age, Gender, Weight, Height, And Bmi Were Collected Using Designed Questionnaire. This Data Is Recorded By Using Weighing Machine And Stadiometer. Body Mass Index (Bmi) Was Calculated As $Bmi (Kg/Mt^2): Weight (Kg)/Height (Mt)^2$. Absolute Renal Size (Cm)³ Was Calculated As: Length (Cm) Width (Cm) X Cortical Thickness (Cm). Renal Volume (Cm)³ Was Calculated As: $0.523 \times Length (Cm) Width (Cm) X Depth (Cm)$. The Sonographic Measurements Were Performed With A High-Resolution Real-Time Scanner (**Philips Iu22; Philips Medical Systems Co. Ltd. Nederland, Usa.**) With A 3.5 Mhz Frequency Curvilinear Probe. The Length, Width And Cortical Thickness At All 3 Poles Of Each Kidney Were Measured For Each Subject.

It Is Recommended That A Subject Undergo A Period Of Fasting Prior To Upper Abdominal Imaging To Maximise The Distension Of The Kidney And To Reduce The Food Residue And Gas In The Upper Gi Tract, Which May Reduce The Image Quality. A Subject May Take Small Amounts Of Still Water By Mouth Prior To Scan, Particularly For Taking Any Medications. Patients Were Required To Empty Their Bladders Before The Examination To Prevent Hydration-Associated Increase In Renal Length. Measurements Were Taken In Deep Inspiration With The Subjects Holding Their Breath Briefly² & Measurements Were Made With The Subjects Lying In Supine Position With Relaxed Abdominal Wall. Longitudinal Scans Were Performed With The Patient In The Decubitus Position Or In Supine Oblique Position.

Technique & Parameters

Once The Kidney Was Located, The Transducer Was Rotated Slightly To Determine The Longest Renal Axis. The Section Which Showed Central Sinus Echoes The Best With The Renal Parenchyma Evenly Distributed All Around The Central Sinus. The Scanning Was Performed From Posterior-Lateral Direction For Obese Patient And Anterolateral Direction For Thin Patients. Renal Length (L) Was Measured As The Longest Pole To Pole Distance Representing The Cranio - Caudal Dimension Of The Kidney In Longitudinal Plane.³ The Maximal Longitudinal Axis Was Evaluated With The Ultrasound Callipers Placed On The Outer Edges Of The Caudal And Cranial Side In The Sagittal Plane To Obtain The Maximum Longitudinal Renal Length. (Length = Superior Pole To Inferior Pole Distance.)^{4, 5, 3, 6} At Least Three Readings Of The Bipolar Kidney Length Imaged On The Longest Axis Were Obtained By Repeated Readjustments Of The Probe. The Average Of These Measurements Was Then Taken As The True Longitudinal Length. The Transducer Was Then Rotated 90 Degrees To The Longitudinal Axis And The Transverse Section Was Obtained At The Level Of The Renal Hilum.⁷ Renal Width (W) Was Defined As The Maximum Dimension In The Transverse Cross-Section At The Level Of The Renal Hilum. The Width Was Measured From The Transverse Ultrasonographic Section Of The Kidney Almost Perpendicular To The Longitudinal Length. The Level Of This Transverse Section Was Intended To Be Placed Quite Close To The Hilum Of The Kidney But At The Same Time Free Of The Pelvis.⁷(Width = Distance Between Medial Border To Lateral Border At Hilum).^{4, 5, 3, 6} Renal Depth Was Measured From Anterior To Posterior Aspect Of Kidney At Its Midpoint In The Same Image Of Transverse Plane.^{5, 3, 6} cortical Thickness Was Defined As The Thickness Of The Cortex Measured At The Each Upper, Middle And Lower Pole And Then Averaged For Each Kidney.⁸ true Supine Position Was Generally Sufficient; However, Slight Elevation Of The Examined Side Was Necessary In A Few Cases For Optimal Visualization. The Data Of All Renal Parameters Are Statistically Analysed, Mean±Sd Is Presented For All Renal Parameters Comparing With Age, Height, Body Weight And Bmi Of The Subject. Frequencies And Percentages Are Computed For Gender, Age Groups, Different Height Groups, Weight Groups, And Different Ranges Of Bmi.⁵ pie-Charts, Bar Diagrams And Line Graphs Are Also Made To Assess The Relationship Between Renal Parameters And Age, Height, Weight And Bmi Of The Subject. Comparative Analysis Of Mean Values Of All Renal Parameters Between Right And Left Kidney, Males And Females, And With Age, Height, Weight And Bmi Of The Subject Are Done By Means Of T-Test And Difference Among The Two Groups Are Considered To Be Significant If P<0.05.

III. Results

Table. 1 Showing Total No. Of Male And Female Subjects In Our Study

S.No	Sex	Total No. Of Subjects	%Of Subjects
1	Male	41	61.19%
2	Female	26	38.8%

Table.2 Showing Mean, Sd And P Values Of Renal Length Of Right And Left Kidney With Height Of The Subject In The Age Group Of 15 - 25 Years

S.No	Height(Cm)	No. Of Subjects	Right Mean	Sd	Left Mean	Sd	P Value
1	151 - 155	5	9.44	0.456	9.66	0.888	0.617
2	156 - 160	8	9.5125	0.724	10.262	0.873	0.004*
3	161 - 165	8	9.7125	0.567	9.7625	0.466	0.837
4	166 - 170	7	9.7166	0.553	10.333	0.817	0.041*
5	171 - 175	6	9.7	0.854	10.01	0.79	0.357
6	176 - 180	5	9.75	0.454	9.92	0.499	0.092

Inference: There Is A Significant Difference Noticed In Mean Renal Length Of Right And Left Kidneys In The Height Group Of 156 – 160 Cm With A **P Value (0.004)** And At Height Group Of 166 – 170 Cm With A **P Value (0.041)**.

Table.3 Showing Mean Renal Width With Height Of The Subject In The Age Group Of 15 - 25 Years

S.No.	Height(N=39)	Mean(N=39)
1	151 – 155	4.46
2	156 – 160	4.225
3	161 – 165	4.7125
4	166 – 170	4.874
5	171 – 175	4.6135
6	176 – 180	5.19

Inference: There Is Gradual Increase Of Mean Renal Width In Relation To The Height Of The Subject.

Table.4 Showing Mean Renal Volume With Height Of The Subject In The Age Group Of 15 - 25 Years

S.No.	Height (N=39)	Mean (N=39)
1	151 – 155	111.204
2	156 – 160	108.99
3	161 – 165	110.66
4	166 – 170	127.717
5	171 – 175	110.815
6	176 – 180	126.239

Inference: There Is Gradual Increase Of Mean Renal Volume In Relation To The Height Of The Subject.

Table.5 Showing Mean Renal Size With Height Of The Subject In The Age Group Of 15 - 25 Years

S.No.	Height (N=39)	Mean (N=39)
1	151 – 155	64.582
2	156 – 160	69.438
3	161 – 165	68.229
4	166 – 170	74.594
5	171 – 175	55.6985
6	176 – 180	57.047

Inference: There Is Gradual Increase Of Mean Renal Size In Relation To The Height Of The Subject Up-To The Height Group Of 166 – 170cm, And Declines Beyond 170cm.

Table.6 Renal Length With Weight

S.No	Weight (Kg)	Renal Length(Cm)								Mean
		Males				Females				
		No.	Right	Left	Mean	No.	Right	Left	Mean	
1	36 – 45	0	0	0	0	4	9.55	10.23	9.888	9.888
2	46 – 55	5	9.3	9.38	9.34	10	9.52	9.83	9.675	9.508
3	56 – 65	19	9.77	10.01	9.89	7	9.985	10.04	10.01	9.952
4	66 – 75	11	9.47	9.718	9.595	5	9.78	9.86	9.82	9.708
5	76 – 85	6	10.3	10.35	10.34	0	0	0	0	10.34

Inference: It States That The Mean Renal Length Increases With Weight Of The Subject. There Is A Slight Significant Difference In Mean Renal Length In Relation To The Weight Of The Subject With A P Value (0.084).

Table. 7 Renal Width With Weight

S.No	Weight (Kg)	Renal Width(Cm)								Mean
		Males				Females				
		No.	Right	Left	Mean	No.	Right	Left	Mean	
1	36 – 45	0	0	0	0	4	4.3	4.4	4.35	4.35
2	46 – 55	5	4.82	5.22	5.02	10	4.11	4.15	4.13	4.575
3	56 – 65	19	4.631	4.9	4.765	7	4.157	4.428	4.292	4.528
4	66 – 75	11	4.436	4.518	4.477	5	4.62	4.6	4.61	4.543
5	76 – 85	6	4.633	5.01	4.821	0	0	0	0	4.821

Inference: It States That The Mean Renal Width Increases With Weight Of The Subject.

Table.08 Renal Size With Weight

S.No	Weight (Kg)	Renal Size(Mm)3								
		Males				Females				Mean
		No.	Right	Left	Mean	No	Right	Left	Mean	
1	36 – 45	0	0	0	0	4	58.61	70.69	64.65	64.65
2	46 – 55	5	58.23	68.36	63.29	10	64.55	66.07	65.31	64.3
3	56 – 65	19	67.83	73.04	70.43	7	63.12	68.07	65.6	68.01
4	66 – 75	11	62.99	66.13	64.56	5	55.97	53.44	54.7	59.63
5	76 – 85	6	93.24	100.7	96.97	0	0	0	0	96.97

Table. 9 Renal Volume With Weight

S.No	Weight (Kg)	Renal Volume(Cm)3								
		Males				Females				Mean
		No.	Right	Left	Mean	No.	Right	Left	Mean	
1	36 – 45	0	0	0	0	4	110.5	108.5	109.5	109.5
2	46 – 55	5	116.7	118.9	117.8	10	98.9	106.7	102.8	110.3
3	56 – 65	19	112.5	120.1	116.3	7	90.43	104.6	97.5	106.9
4	66 – 75	11	99.04	99.57	99.3	5	102.4	111.8	107.1	103.2
5	76 – 85	6	134.4	135.8	135.1	0	0	0	0	135.1

Table.10 Renal Length With Bmi

S.No	Bmi (Kg/M2)	Renal Length(Cm)								
		Males				Females				Mean
		No.	Right	Left	Mean	No.	Right	Left	Mean	
1	15.00 – 20.99	13	9.626	9.892	9.759	13	9.53	9.969	9.749	9.754
2	21.00 – 25.99	19	9.605	9.81	9.707	12	9.866	9.966	9.916	9.812
3	26.00 – 30.99	6	9.683	9.766	9.724	1	9.9	9.6	9.75	9.737
4	31.00 – 35.99	3	10.87	10.83	10.85	0	0	0	0	10.85

Table.11 Showing Mean, Sd And P Values Of Mean Renal Length With Bmi Of The Subject

S.No	Bmi (Kg/M2)	Mean (N=67)	Sd (N=67)	P Value
1	15.00 – 20.99	9.754	0.62	0.037
2	21.00 – 25.99	9.789	0.62	
3	26.00 – 30.99	9.729	0.47	
4	31.00 – 35.99	10.85	0.7	

Inference: The Above Table Shows, There Is A Significant Difference In Mean Renal Length In Relation To The Bmi Of The Subject With A P Value (0.037).

Table.12 Showing Mean Renal Length Of Right And Left Kidney, Sd And P Values With Bmi Of The Subjects

S.No	Bmi (Kg/M2)	Right Mean (N=67)	Sd (N=67)	Left Mean (N=67)	Sd (N=67)	P Value
1	15.00 – 20.99	9.578	0.65	9.9305	0.79	0.02*
2	21.00 – 25.99	9.7355	0.75	9.888	0.72	0.247
3	26.00 – 30.99	9.7915	0.46	9.683	0.51	0.76
4	31.00 – 35.99	10.866	0.64	10.83	0.76	0.667

Inference: The Left Mean Renal Length Is More Than The Right In Both Genders And The Mean Renal Length Of Right And Left Kidney At Bmi Ranging From 15.00 – 20.99 Kg/M² Is Significant With A P Value(0.02) And Noticed That The Mean Renal Length Increases With The Bmi Of The Subject. Mean Renal Length Is Best Correlated With The Bmi Of The Subject.

Table.13 Renal Width With Bmi

S.No	Bmi (Kg/M2)	Renal Width(Cm)								
		Males				Females				Mean
		No.	Right	Left	Mean	No.	Right	Left	Mean	
1	15.00 – 20.99	13	4.815	5.169	4.992	13	4.169	4.238	4.203	4.597
2	21.00 – 25.99	19	4.494	4.642	4.568	12	4.308	4.458	4.383	4.475
3	26.00 – 30.99	6	4.283	4.783	4.533	1	4.6	4.5	4.55	4.541
4	31.00 – 35.99	3	5	4.966	4.983	0	0	0	0	4.983

Table.14 Renal Volume With Bmi

S.No	Bmi (Kg/M2)	Renal Volume (Cm)3								
		Males				Females				Mean
		No.	Right	Lrft	Mean	No.	Right	Left	Mean	
1	15.00 – 20.99	13	114.8	123.7	119.2	13	103.2	106.8	105	112.1
2	21.00 – 25.99	19	106.4	109.2	107.8	12	96.95	109.2	103.1	105.4
3	26.00 – 30.99	6	109.5	110.8	110.1	1	71.45	92.63	82.04	96.08
4	31.00 – 35.99	3	149	146.5	147.7	0	0	0	0	147.7

Table.15 Renal Size With Bmi

S.No	Bmi (Kg/M2)	Renal Size (Mm)3								
		Males				Females				Mean
		No.	Right	Left	Mean	No.	Right	Left	Mean	
1	15.00 – 20.99	13	59.65	70.75	65.2	13	60.99	66.57	63.78	64.49
2	21.00 – 25.99	19	68.29	69.78	69.04	12	62.16	64.16	63.31	66.17
3	26.00 – 30.99	6	71.05	84.49	77.77	1	59.2	51.84	55.52	66.64
4	31.00 – 35.99	3	111	102.8	106.9	0	0	0	0	106.9

Table.16 Showing Mean, Sd And P Values Of Mean Renal Size With Bmi Of The Subject

S.No	Bmi (Kg/M2)	Mean (N=67)	Sd (N=67)	P Value
1	15.00 – 20.99	64.49	21.64	0.046
2	21.00 – 25.99	66.82	27.43	
3	26.00 – 30.99	74.59	23.54	
4	31.00 – 35.99	106.9	23	

Inference: The Above Table Shows That The Mean Renal Size Increases With Bmi Of The Subject. There Is A Significant Difference In Mean Renal Size In Relation To The Bmi Of The Subject With A P Value (0.046).

Table.17 Showing Mean Renal Size Of Right And Left Kidney With Bmi Of The Subjects

S.No	Bmi (Kg/M2)	Right Mean (N=67)	Sd (N=67)	Left Mean (N=67)	Sd (N=67)	P Value
1	15.00 – 20.99	64.49	20.99	68.66	27.12	0.063
2	21.00 – 25.99	66.82	29.95	66.97	27.22	0.596
3	26.00 – 30.99	74.5935	22.77	68.165	26.53	0.117
4	31.00 – 35.99	110.97	19.36	102.84	26.75	0.218

Inference: Regarding The Above Table, The Right Mean Renal Size Is More Than The Left In Both Genders And Noticed That The Mean Renal Size Of Both Kidneys Increases With The Bmi Of The Subject. A Slight Significant Difference Of Mean Renal Size Of Right And Left Kidneys At Bmi Ranging From 15.00 – 20.99 Kg/M² With A P Value Of (0.063).

IV. Discussion

Medical Imaging Has Played An Important Role In Helping Physicians To Make A Medical Diagnosis. One Such Safe And Easily Available Technique World-Wide Is Ultrasound Imaging. Ultrasound Imaging Also Known As Ultrasound Scanning Or Sonography Is A Relatively Inexpensive, Fast, Non - Invasive And Radiation Free Imaging Modality.²ultrasonography Is Widely Accepted And Considered As The Tool Of Choice Especially Where Repeated Examinations Are Required.⁹in The Present Study A Total Of 67 Adult Subjects Without Any Known Renal Disease Were Investigated For The Period Of One Year From May 2016 To May 2017. The Data Were Collected From Various Age Groups (11 – 20, 21 – 30, 31 – 40, 41 – 50, 51 – 60 And 61 – 70 Years). The Mean Age In This Study Is Mean±Sd: 28.81±11.48. The Renal Dimensions (Length, Width, Cortical Thickness, Renal Size And Renal Volume) Are Measured In The Above Mentioned Age Groups Of 67 Subjects At Radiology Department In Svims Hospital. The Present Study Was Undertaken To Determine The Normal Renal Dimensions Which May Help In The Diagnosis Of Kidney Diseases. The Renal Measurements Play A Vital Role For The Clinicians To Determine The Health Status And To Visualize Any Abnormalities Present In The Kidneys. Renal Size May Be An Indicator Of The Loss Of Kidney Mass And Kidney Function. Out Of 67 Subjects Included, 41 Subjects Are From Males And 26 Subjects From Females. The Highest Percentage Noted Among Males (61.19%) Compare To Females (38.8%). Among 67 Subjects Of Various Age Groups Present In The Study Are Categorised In Relation To Height Of 15 -25 Age Group Individuals Ranging From 151 – 155 Cm, 156 -160 Cm, 161 – 165 Cm, 166 – 170 Cm, 171 – 175 Cm, 176 – 180 Cm. The Mean Height Is Mean±Sd: 165.81±8.51, In Relation To Weight Of The Total Subjects Ranging

From 36 – 45kg, 46 – 55kg, 56 – 65kg, 66 – 75kg, 76 - 85kg. The Mean Weight Is Mean±Sd: 61.87±10.82, And In Relation To Body Mass Index Of The Total Subjects Ranging From 15.00 – 20.99 Kg/M², 21.00 – 25.99 Kg/M², 26.00 -30.99 Kg/M², 31.00 – 35.99 Kg/M². The Mean Body Mass Index Is Mean±Sd: 21.51±10.83. In This Study Measurements Of Renal Dimensions Length, Width, Cortical Thickness, Renal Size And Renal Volume Of Right And Left Kidney Has Been Taken And Compared Between Both Genders Of Various Age Groups In Relation To Height, Weight And Body Mass Index.

Length With Height

The Total Mean Renal Length Of Right And Left Kidney In Both Genders In The Age Group Of 15 – 25 Years In Relation To The Height Of The Subject Ranging From 151 – 155 Cm, 156 – 160 Cm, 161 – 165 Cm, 166 – 170 Cm, 171 – 175 Cm, 176 – 180 Cm. Right Kidney Measurements Are 9.44, 9.5125, 9.7125, 9.7166, 9.7, 9.75, And Left Kidney 9.66, 10.262, 9.7625, 10.333, 10.01, 9.92. There Is A Significant Difference Of Right And Left Kidney Renal Length In The Height Group 156 – 160cm With A P Value (0.004) And At 166 -170cm With A P Value (0.041). **A. Hekmatnia Md*, Et Al.¹⁰ In 2004, Seyed Alireza Emamian’ Et Al.⁷ In 1993 In 2004** States That Renal Length Of Both Kidneys And Subjects Height Are Proportionately Going Up. In The Present Study It Is Not So But A Minor Correlation With The Above Study That The Right Renal Length Proportionately Increases With Height Whereas The Left Kidney Length Increase Up To The Height Of 170 Cm And Thereafter It Gradually Decreases.

Length With Weight

The Total Mean Renal Length Of Both Kidneys Of Both Genders In Relation To The Weight Of The Subject. The Renal Length Is Increasing With Subject’s Body Weight Which Is Somewhat Similar To The Studies Of **Seyed Alireza Emamian’ Et Al.⁷ In 1993, Prakash Muthusami, Et Al.¹¹ In The Year 2014, Wael El-Reshaid Et Al.¹² In The Year 2014, Subodh Kumar Yadav, Et Al.¹³ In The Year 2017**. A Moderate Positive Correlation Is Noticed In The Present Study With A P Value Of (0.084).

Length With Bmi

According To The Studies Conducted By **Mujahid Raza, Et Al.⁵ In The Year 2011, Wael El-Reshaid, Et Al.¹² In The Year 2014, Subodh Kumar Yadav, Et Al.¹³ In The Year 2017**. They Stated That The Renal Length Is Significantly Associated With The Bmi. In The Present Study Also The Total Mean Renal Length Of Both Kidneys Irrespective Of Gender Is Significantly Associated With Bmi Of The Subject With A P Value Of (0.037). The Renal Length Increases With The Weight Of The Subject.

Width With Height

The Height Of The Subjects Within The Age Group Of 15 – 25 Years In A Total Of 39 Subjects From Total Number Of Subjects 67 Included In The Study Noticed That The Mean Renal Width Of The Subjects In Relation To Height Of The Subject Ranging From 151 – 155 Cm, 156 – 160 Cm, 161 – 165 Cm, 166 – 170 Cm, 171 – 175 Cm, 176 – 180 Cm, Renal Width Measurements Are 4.46, 4.225, 4.7125, 4.874, 4.6135, 5.19 Shows That There Is Gradual Increase In Renal Width With Height Of The Individual.

Width With Weight And Bmi

The Mean Renal Width Measurements In Relation To Weight Of The Total Subjects Ranging From 36 – 45kg, 46 – 55kg, 56 – 65kg, 66 – 75kg, 76 - 85kg, Mean Renal Width Measurements Are 4.35, 4.575, 4.528, 4.543, 4.821cm And Mean Renal Width Measurements In Relation To Bmi Of The Total Subjects Ranging From 15.00 – 20.99 Kg/M², 21.00 – 25.99 Kg/M², 26.00 -30.99 Kg/M², 31.00 – 35.99 Kg/M², Mean Renal Width Measurements Are 4.598, 4.497, 4.536, 4.983. It Shows That The Total Mean Renal Width Of Both Kidneys Irrespective Of Gender Increases With Weight And Bmi Of The Subject.

Renal Size With Height

The Total Mean Renal Size Of The Subjects Within The Age Group Of 15 – 25 Years In A Total Of 39 Subjects From Total Number Of Subjects 67 Included In The Study Noticed That The Mean Renal Size Of The Subjects In Relation To Height Of The Subject Ranging From 151 – 155 Cm, 156 – 160 Cm, 161 – 165 Cm, 166 – 170 Cm, 171 – 175 Cm, 176 – 180 Cm, The Total Mean Renal Size Measurements Are 64.582, 69.438, 68.229, 74.594, 55.6985, 57.047, Shows That There Is Gradual Increase Of Renal Size Up To The Height Of 170cm And Thereafter It Decreases. It Is Not Similar To The Study Done By **Adeela Arooj, Et Al.² In The Year 2011** Who Observed That There Is A Positive Correlation Between Renal Size And Subject’s Height.

Renal Size With Weight

In The Present Study The Total Mean Renal Size Of The Subjects Is Correlated With Weight Of The Subjects And There Is A Positive Correlation Between Renal Size And Weight With P Value (0.057). The Work Done By **Adeela Arooj, Et Al.² In The Year 2011** Also Stated That There Is A Positive Correlation Between The Total Mean Renal Size And Weight Of The Subject.

Renal Size With Bmi

The Study Conducted By **Shilan Hussein Karim, Et Al.¹⁴ In The Year 2013-14** Concluded That There Is A Positive Correlation Between The Renal Size With Bmi, And It Is Also Reflected By Results Obtained In The Present Study Of The Total Subjects Ranging From 15.00 – 20.99 Kg/M², 21.00 – 25.99 Kg/M², 26.00 -30.99 Kg/M², 31.00 – 35.99 Kg/M² And The Renal Size Measurements Are 64.49, 66.82, 74.59, 106.9cm³. There Is A Significant Increase In Total Mean Renal Size With The Increase In Bmi With A P Value (0.046).

Renal Volume With Height

Regarding The Total Mean Renal Volume Of The Subjects Within The Age Group Of 15 – 25 Years In A Total Of 39 Subjects From Total Number Of Subjects 67 Included In The Study Noticed That The Mean Renal Volume Of The Subjects In Relation To Height Of The Subject Ranging From 151 – 155 Cm, 156 – 160 Cm, 161 – 165 Cm, 166 – 170 Cm, 171 – 175 Cm, 176 – 180 Cm, The Total Mean Renal Volume Measurements Are 111.204, 108.99, 110.66, 127.717, 110.815, 126.239cm³, Shows That There Is Gradual Increase Of Renal Volume In Relation To The Height Of The Subject.

Renal Volume With Weight

The Statement Made By **Rasmussen Sn. Haase L, Et Al.¹⁵ In The Year 1978** That The Ratio Between The Renal Volume And Body Weight Is Relatively Dependent And Accurate And Is Best Correlating With The Results Obtained In The Present Study. The Results Of Total Renal Volume With Weight Of The Subject Ranging From 36 – 45kg, 46 – 55kg, 56 – 65kg, 66 – 75kg, 76 - 85kg, The Total Mean Renal Volume Measurements Are 109.5,110.3, 106.9, 103.2, 135.1cm³. Hence, It Is Concluded That The Total Mean Renal Volume Increases With The Weight Of The Subject.

Renal Volume With Bmi

According To The Work Of **Mujahid Raza, Et Al.⁵ In The Year 2011** Observed Direct Relationship Between Renal Volume And Bmi. The Same Is Observed In The Present Study That The Total Mean Renal Volume In Relation To The Bmi Of The Total Subjects Ranging From 15.00 – 20.99 Kg/M², 21.00 – 25.99 Kg/M², 26.00 -30.99 Kg/M², 31.00 – 35.99 Kg/M² And The Renal Volume Measurements Are 112.1, 106, 106.1, 147.7.

V. Conclusion

The Present Study On Kidney By Ultrasonography Has Lot Of Significance Because Of Impounding Renal Pathologies Causing Alarming Death Rate. The Ultrasonography Method Is Chosen For The Present Study Based On Several Advantages Like Cost– Effective, Non – Invasive And Advantage Of Repetitive Studies. The Ultrasonography Method Forms Important Tool For Investigating Renal Pathologies And For Which The Normal Renal Data Of Various Parameters Is Necessary. In The Present Study 67 Normal Subjects Of Both Genders (Males: 41, And Females: 26) Were Chosen To Observe Various Renal Parameters. It Is Observed That The Total Mean Renal Length Of Both Kidneys Increase With Age Up - To 60 Years And Thereafter The Decline Is Observed With A Significant P Value (0.055) Is Observed. The Length Of The Left Kidney Is Significantly More Than The Right Kidney In Both The Genders With A Significant P Value (0.015). With Relevance To The Gender It Is Observed That The Length Of The Right And Left Kidneys Is More In Males Than In Females. The Data Regarding The Relationship Between Height Of The Subjects And The Renal Length Indicate That The Renal Length Increases Up-To The Height Of 170 Cm And A Decline In The Renal Length Is Observed Beyond The Height Of The 170 Cm In Both The Genders. It Is Observed That The Increase In Renal Length Is Proportionate To The Body Weight And Bmi With A Significant P Value (0.037) In Both The Genders. The Renal Width Of Both The Kidneys In Both The Genders Increases Up-To Fifth Decade And A Gradual Decline Is Observed Thereafter. It Is Observed That The Mean Renal Width Of Both The Kidneys Is More In Males Than Females With A Significant P Value (0.013). The Analysis Of Available Data Reflects The Proportionate Increase In Renal Width In Relation To Body Weight And Bmi. The Comparative Study Of Renal Size With Reference To The Gender Shows That In The Males The Kidney Size Is Larger Than Females. The Data Reveals That The Renal Size In Both Genders The Renal Size Of Left Kidney Is More Than The Right With A Significant P Value (0.043). The Data Reveals That The Real Size Increases Up-To The Height Of 170

Cm And Decline Thereafter. It Is Observed That The Renal Size Proportionately Increases With Weight Of The Subject And With The Increase In Bmi With Significant P Value (0.046). The Increase In Renal Volume With Relevance To Increase In Height, Weight And Bmi Is Observed And In General It Is Observed That The Left Kidney Mean Renal Volume Is More Than The Right. The Parameter Of Cortical Thickness Increases Up-To The Age Of 31 – 40 Years And Thereafter General Decrease In Cortical Thickness Is Observed. It Is Also Observed That The Cortical Thickness In Males Is More Than The Females, And Regarding The Side More So On Left Side. In General, Considering The Available Data It Is Observed That All The Parameters Are Relatively More In Males Than Females, And The Data Analysis Reveal That All The Parameters Are More In Relation To The Left Kidney Than The Right One.

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