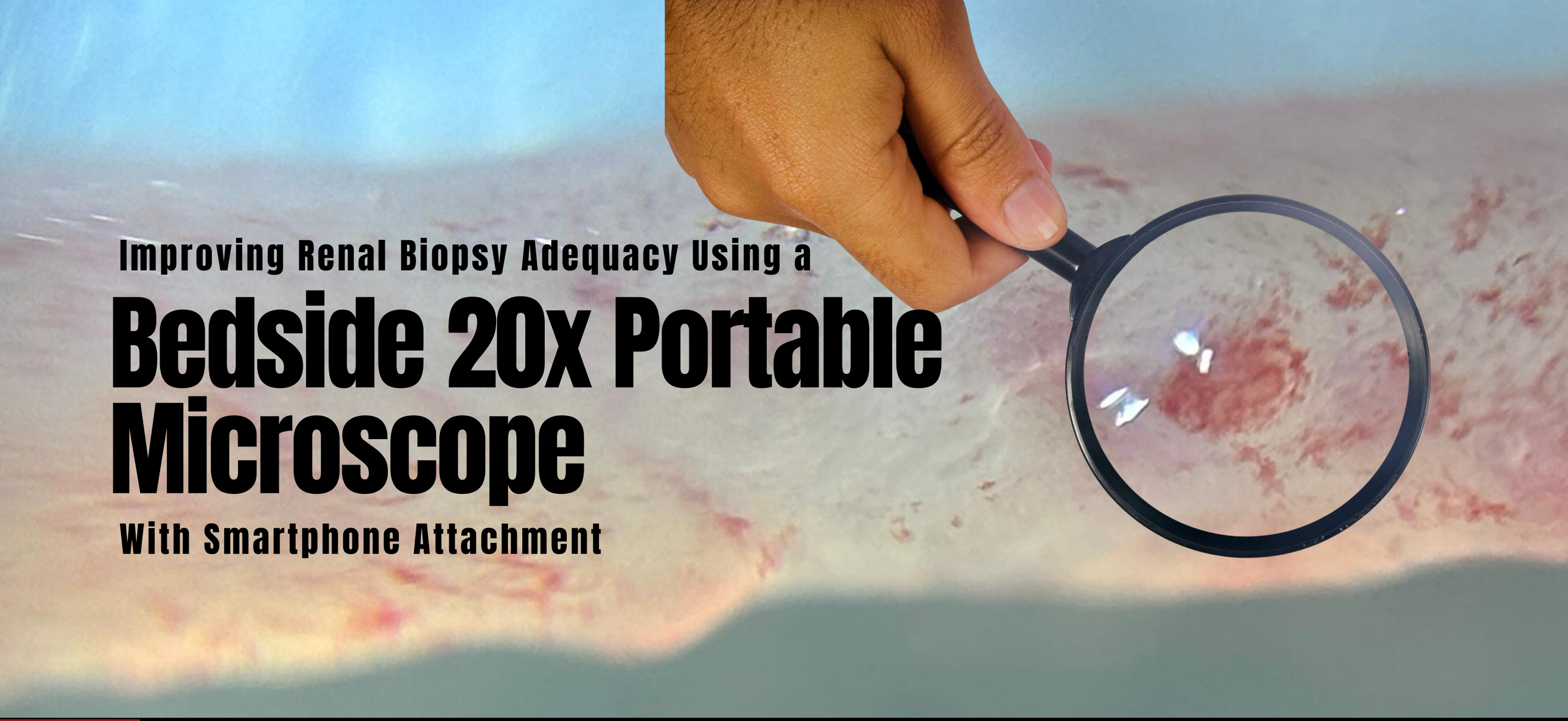

Improving Renal Biopsy Adequacy Using a

Bedside 20x Portable Microscope

With Smartphone Attachment

Presented by

Dr Amit Kumar Mohanty

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Asian Institute of Nephrology and Urology, Hyderabad, India

APCN×TSN 2025

Dec. 5 Fri. ▷ Dec. 7 Sun. 2025 TaiNEX 2, Taipei Taiwan

Link the Future Kidney Health with GIVE

Gene, Immunology, Vast, MEtabolism at its Finest!

THE OUTLINE

01 | The Problem

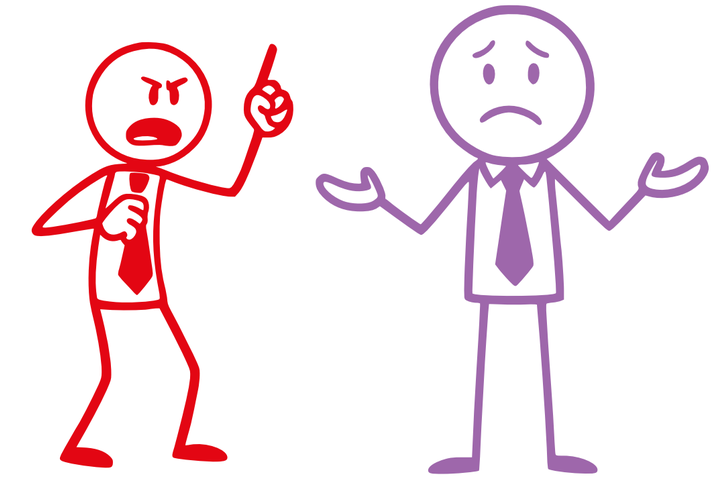
02 | Literature

03 | Study Protocol and Methods

04 | Results & Discussion

05 | Conclusion

THE PROBLEM

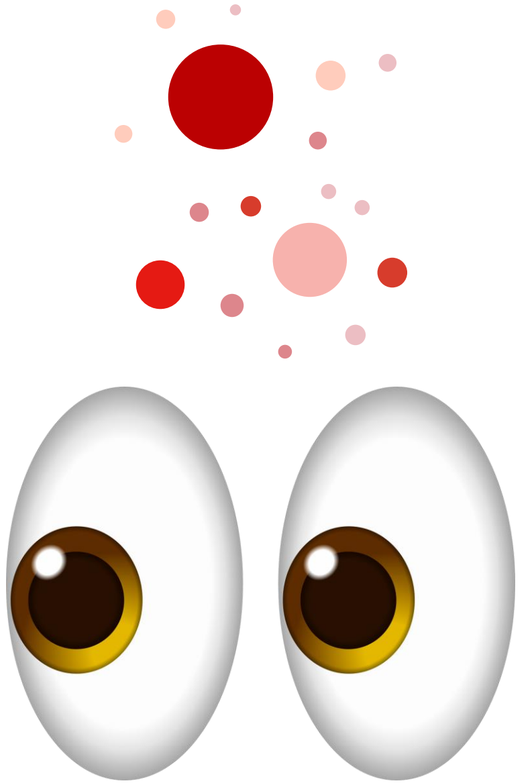


REPEAT
biopsy

Renal Biopsy done

Inadequate core

THE OPTIONS



UNAIDED
EYES

MAGNIFYING
LENS

THE OPTIONS

DISSECTING MICROSCOPE

CORE HANDLING

Risk of Damage to the tissue

TIME

Longer durartion before placing the tissue in fixative = reduces core quality

NO DIGITAL STORAGE OF DATA

No method to store the picture for reference and research

THE OPTIONS

SMARTPHONE
CAMERA

ADEQUATE LIGHTING

Poor image quality in absence of adequate lighting

FLASH GLARE

To get clearer image - flash is required = but it gives glare

MACRO LENS

Macro lens capability comes in very high end devices

THE OPTIONS

good
Lens

SMARTPHONE
WITH
MACRO LENS
ATTACHMENT

extra
Light

THE LITERATURE

RESEARCH LETTERS www.jasn.org

Use of a Smartphone Camera at the Bedside to Assess Adequacy of Kidney Biopsies

Gurmukteshwar Singh [1], Mark Massak,[2] Michael Czaplicki,[2] Evan Young,[2] Shree Sharma,[3] Alex Chang [1], Ashok Bhanushali,[2] and Prince Anand [1]

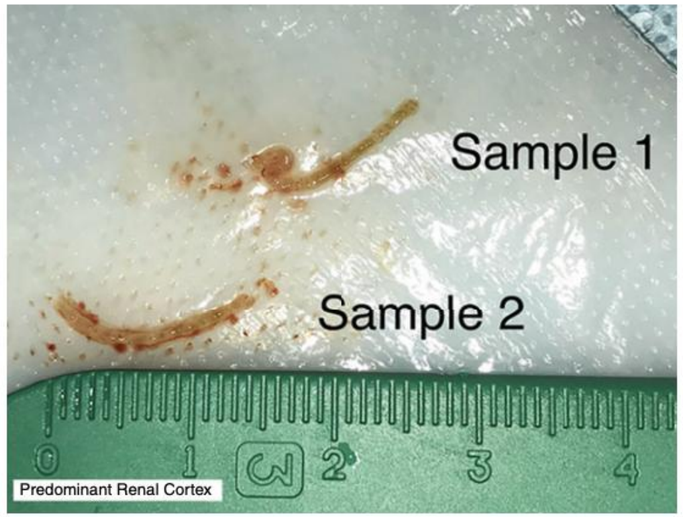
[1] Department of Nephrology, Geisinger Health, Danville, Pennsylvania
[2] Department of Radiology, Geisinger Health, Danville, Pennsylvania
[3] Nephropathology Division, Arkana Laboratories, Little Rock, Arkansas

JASN 32: 3024–3026, 2021. doi: https://doi.org/10.1681/ASN.2021070898

APPLE iPhone 7

57 CORES

A



B

THE LITERATURE

Research article

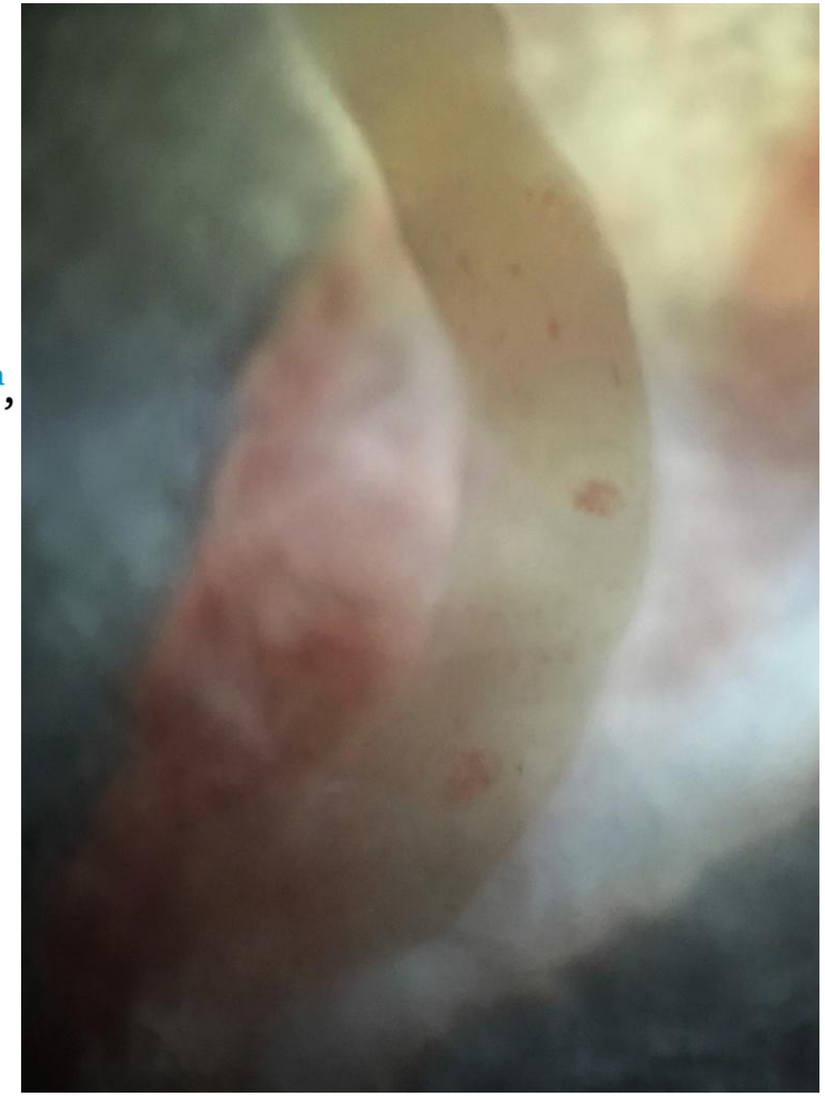
Improvement of allograft kidney biopsy yield by using a handheld smartphone microscope as an on-site evaluation device

Wichien Sirithanaphol [a], Natthida Incharoen [a], Ukrit Rompsaithong [a], Pakorn Kiatsopit [a], Supanut Lumbiganon [a], Jarin Chindaprasirt [b,*]

[a] *Division of Urology, Department of Surgery, Khon Kaen, 40002, Thailand*
[b] *Department of Internal Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, 40002, Thailand*

CHULA
smart lens

93
ALLOGRAFT
BIOPSIES



THE LITERATURE

Original Article
34(3);233-236
doi:10.4103/ijn.ijn_323_23

Bedside Method to Check the Adequacy of Kidney Biopsy Sample with a Smartphone Camera and Macro Lenses: A Prospective Cohort Study

Suny S. Modi[1], Satheesh Ramamurthy[2], S. Balasubramanian[3], Sunil Kumar[4], Feral Daruwala[5]

[1]Department of Nephrology, Vishesh – Jupiter Hospital, Indore, Madhya Pradesh, India
[2]Department of Interventional Radiology, Apollo Hospitals, Chennai, Tamil Nadu, India
[3]Department of Nephrology, Apollo Hospitals, Chennai, Tamil Nadu, India
[4]Department of Renal Pathology, Apollo Hospitals, Chennai, Tamil Nadu, India
[5]Department of Medical Writer, NEPHROLIFE-The Complete Kidney Care, Surat, Gujarat, India

Corresponding author: Dr. Suny S. Modi, Department of Nephrology, Vishesh - Jupiter Hospital, Ring Road, Near Teen Imli Square Indore, Madhya Pradesh, India. E-mail: sunynephrology@gmail.com

16 MP
Macro Lens

48
CORES

Improving Renal Biopsy Adequacy Using a

Bedside 20x Portable Microscope

With Smartphone Attachment

Fixed Zoom

focus Ring

Clip on magnet

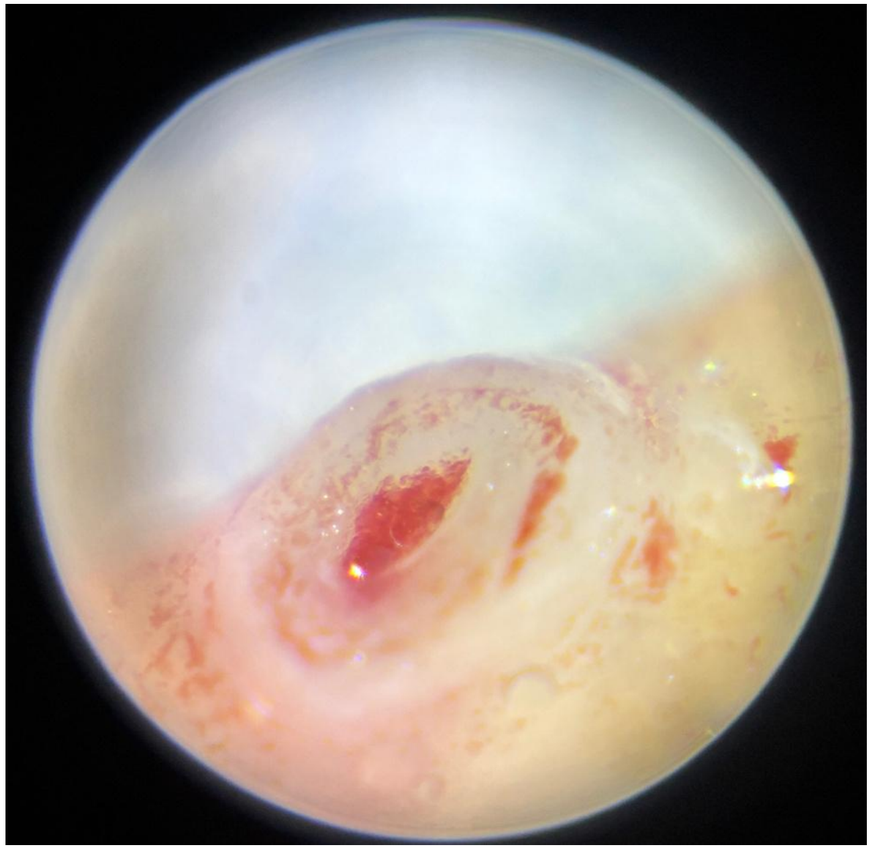
100 - 250x zoom

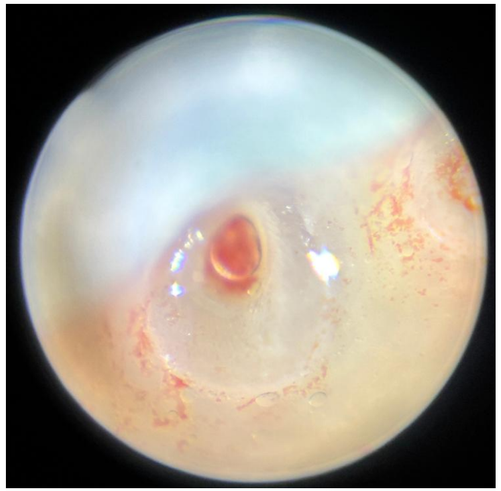
With Slide

Too much ZOOM

Unstable movements

No added Value





THE OBJECTIVES

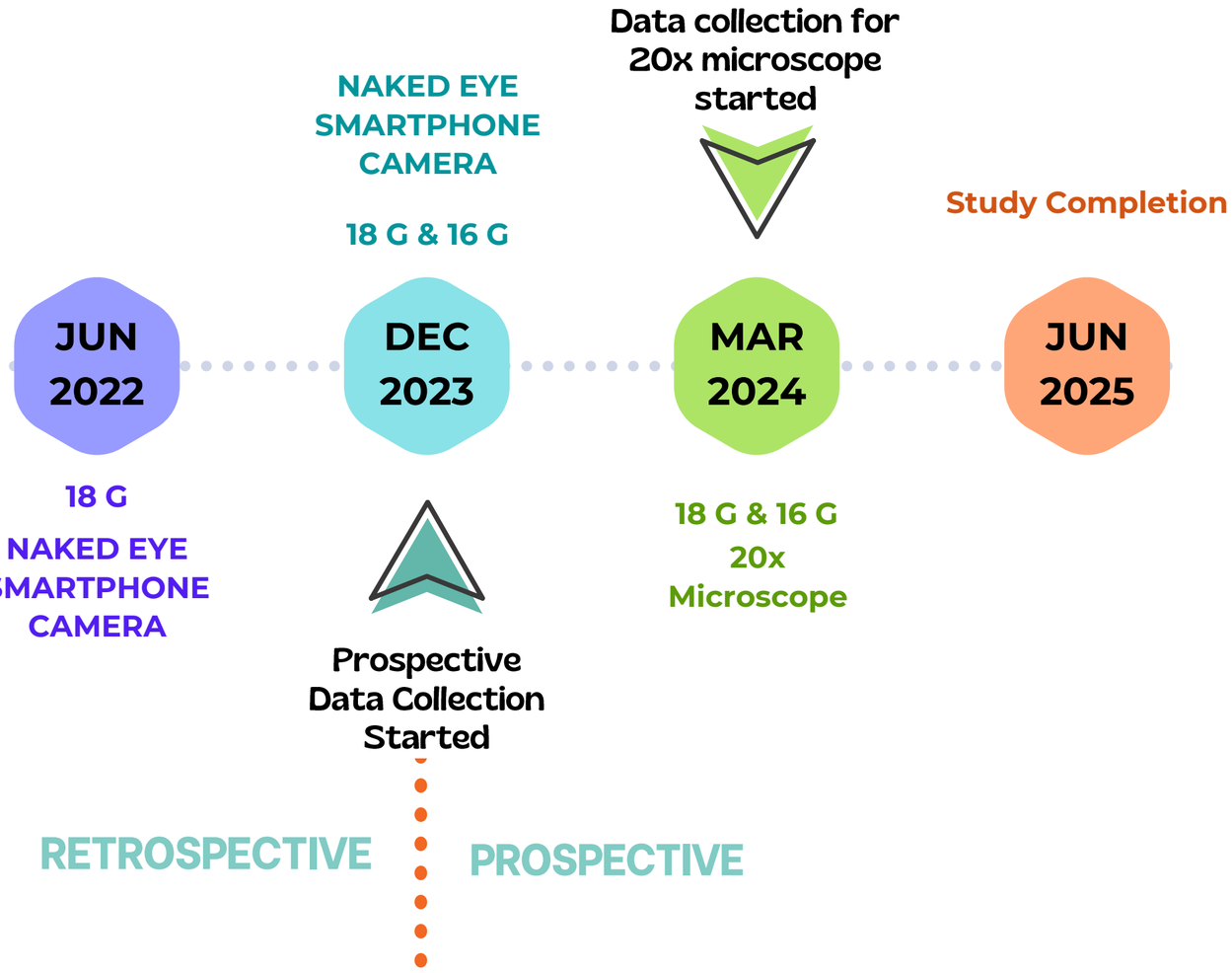
Primary Objective

- To compare the core adequacy with and without the use of a 20x portable microscope

Secondary Objective

- To assess the accuracy of predicting the minimum number of glomeruli at bedside with 20x portable microscope.
- To compare the correlation of core length with the number of glomeruli.
- Subgroup analysis of core adequacy between 16G and 18G biopsy needles

THE METHODOLOGY



Type of Study

Retrospective + Prospective Comparitive Analysis

Population

Native Kidney + allograft Biopsies at AINU Hyderabad, India

Duration

3 years
Prospective = 18 months
Retrospective = 18 months

- Telephonic patient interaction
- Medical Records
- Renal Biopsy report

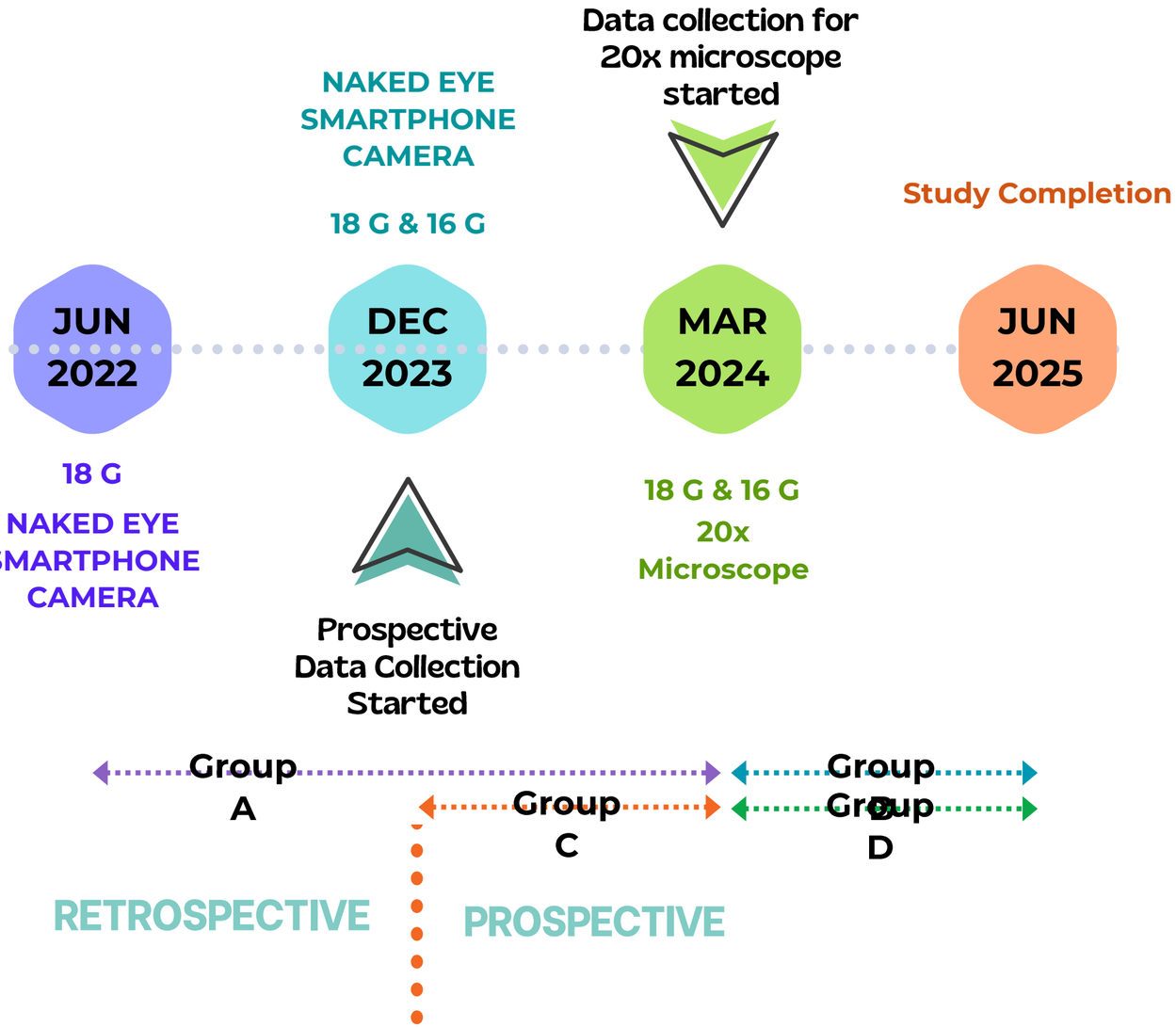
Inclusion

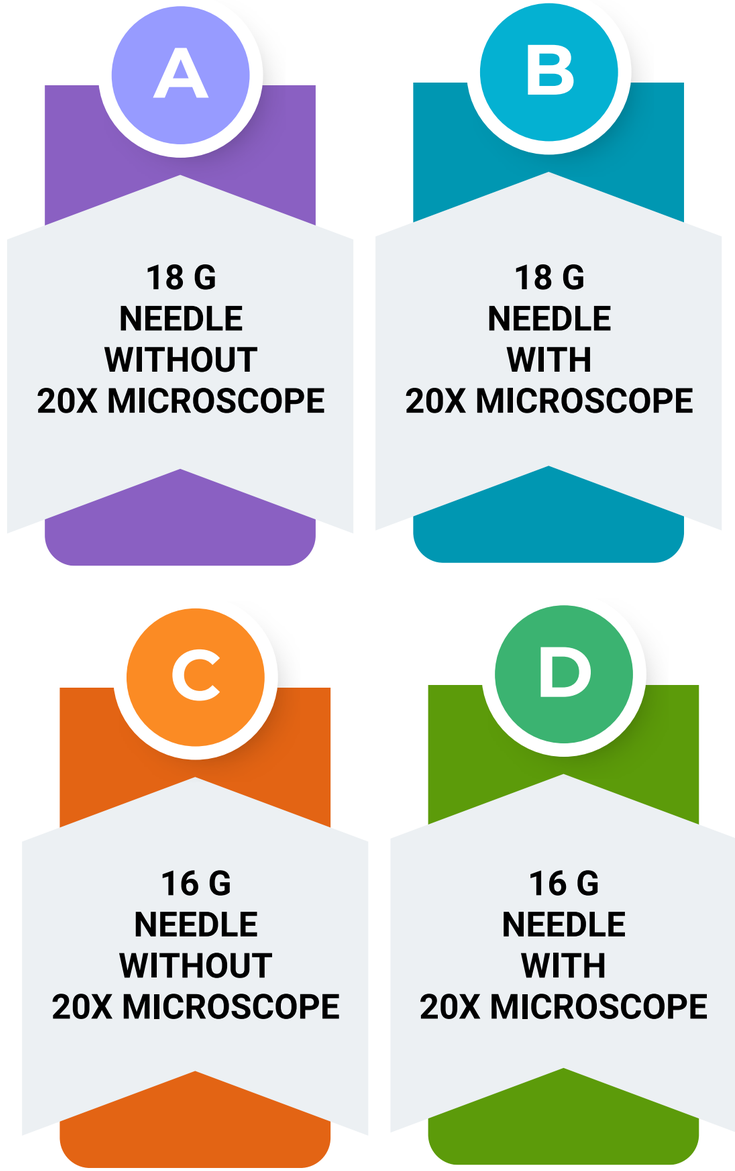
> 18 years undergoing native kidney or allograft biopsy with consent

Exclusion

No consent

THE METHODOLOGY





THE METHODOLOGY

Equipments Used

- 18 G BARD Renal Biopsy gun
- 16 G BARD Renal Biopsy gun
- CARSON 20x microscope with smartphone attachment
- Any available Smartphone with camera
- Surgical Skin marking Scale for Core length Calculations

Definition of Adequacy

- **Native kidney biopsies**:
  - ≥ 10 glomeruli for LM
  - ≥ 1 glomerulus each for IF and EM
- **Renal allograft biopsies:**
  - ≥ 10 glomeruli AND ≥ 2 arteries for LM
  - ≥ 1 glomerulus each for IF and EM

STEPS

Renal Biopsy

Consent

Pre-biopsy evaluation
Biopsy Performed as per standard protocol

Needle gauze decided as per Operator

Core Evaluation Bedside

Core evaluation using 20x CARSON Pocket microscope with Smartphone attachment

Following were noted-
a) Glomeruli count
b) Core length using surgical skin marking scale
c) Any additional peculiar findings

Additional Pass (If Required)

After initial evaluation of core, additional Pass requirement was decided based on clinical requirement

Comparision with Final Biopsy Report

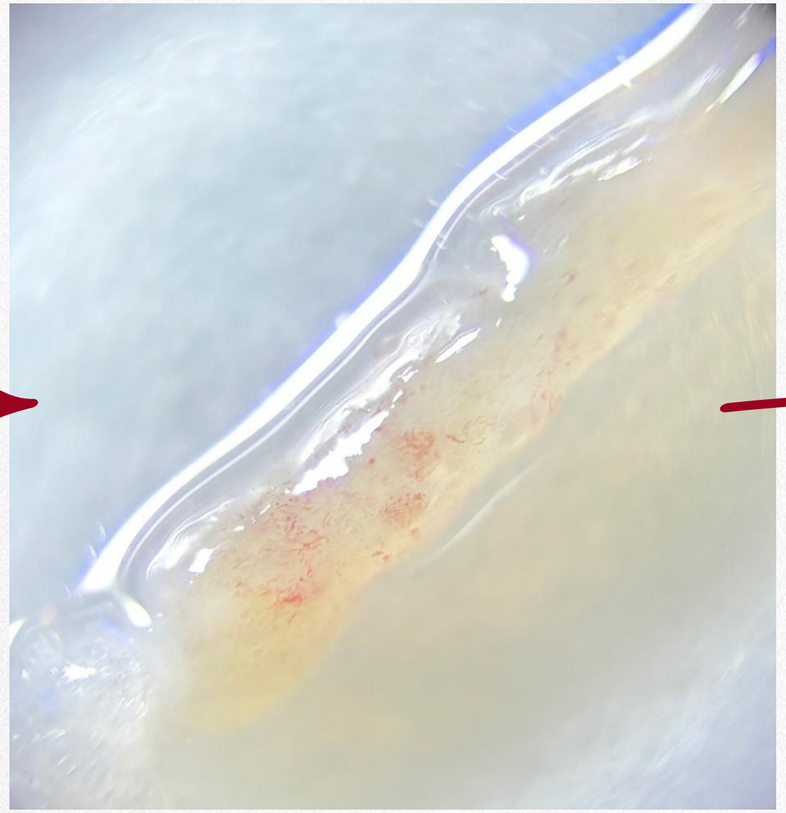
Once the final biopsy report is available, the data was noted down-
a) Glomerular number
b) Final diagnosis

Statistical Analysis

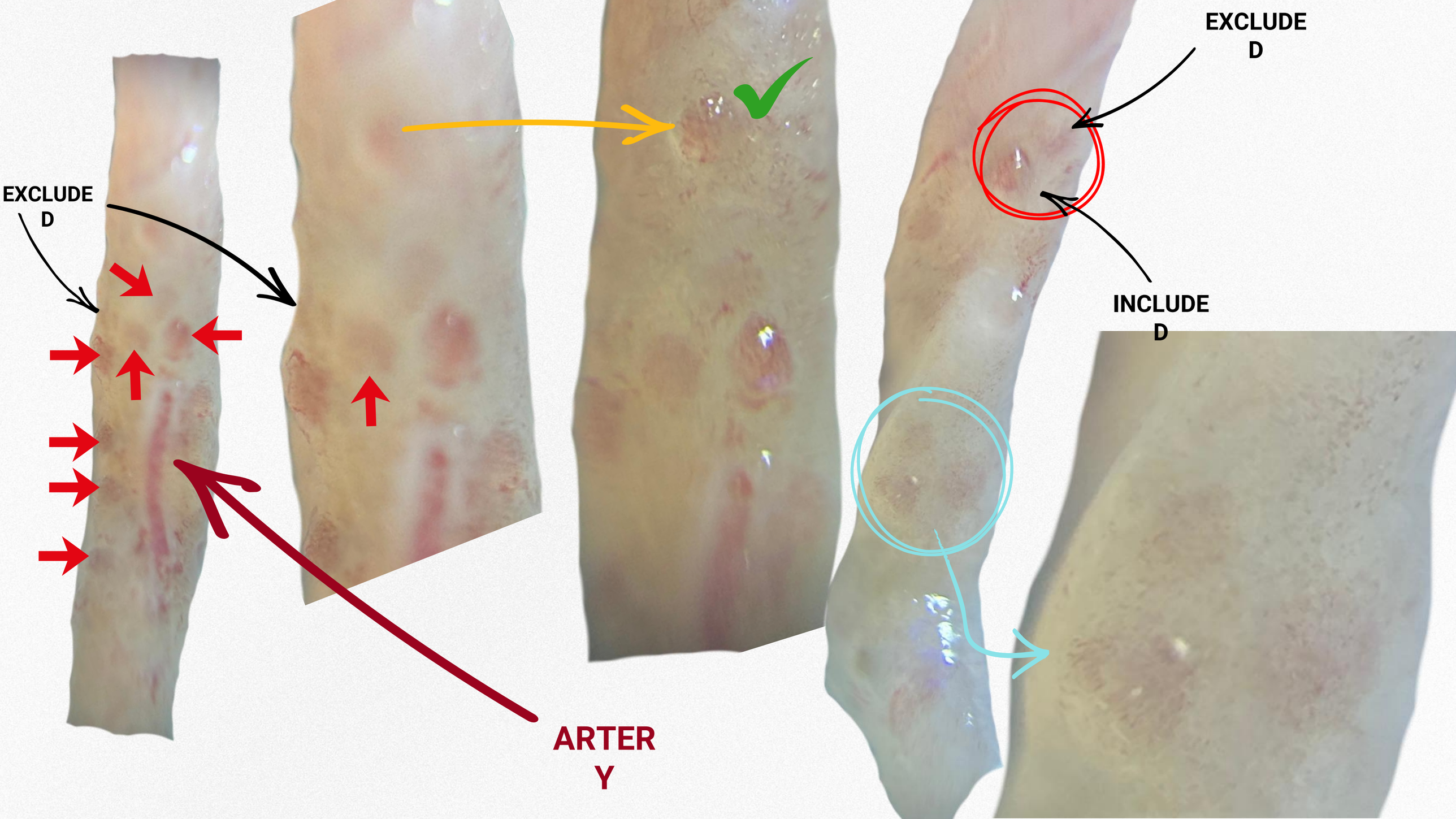
Statistical analysis was done using -
a)Student T Test
b)Fisher's Exact Test
c)Pierssion Coefficient

COUNTING THE GLOMERULI

Rinse the Core with Normal Saline



Soak the extra saline with bloating paper


EXCLUDE
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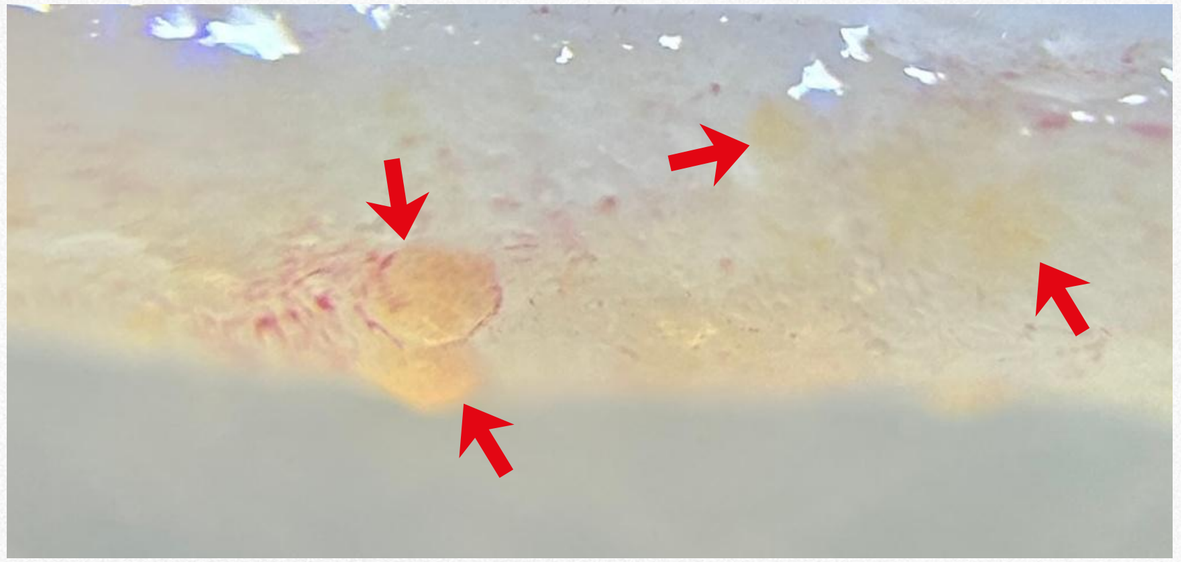
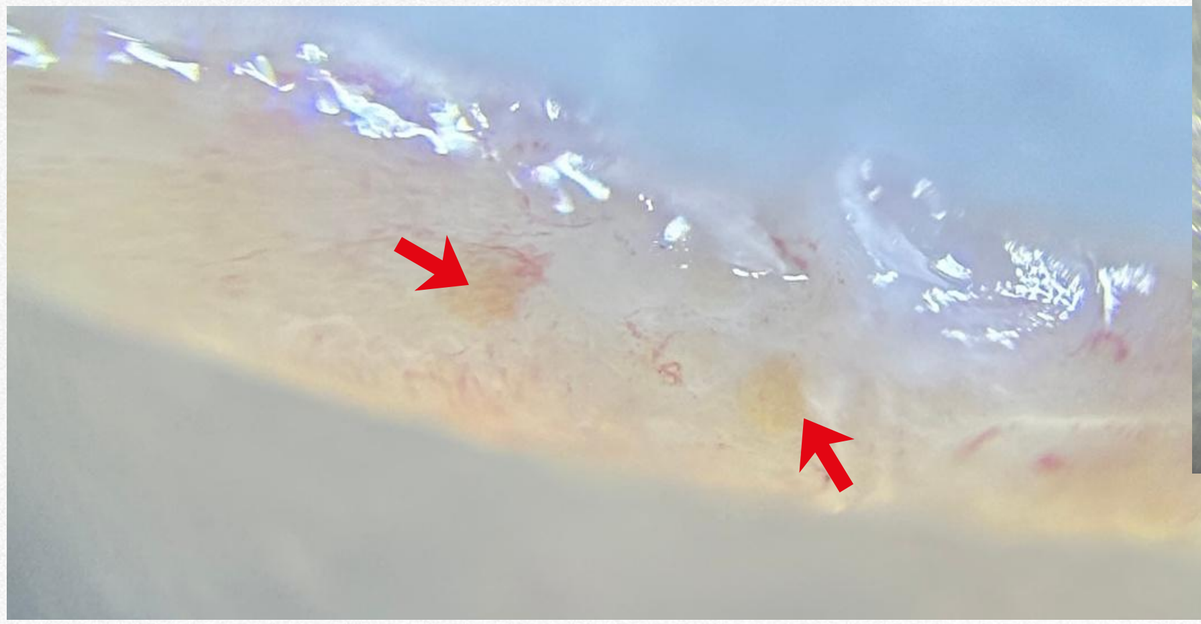
ARTER
Y

COUNTING THE GLOMERULI

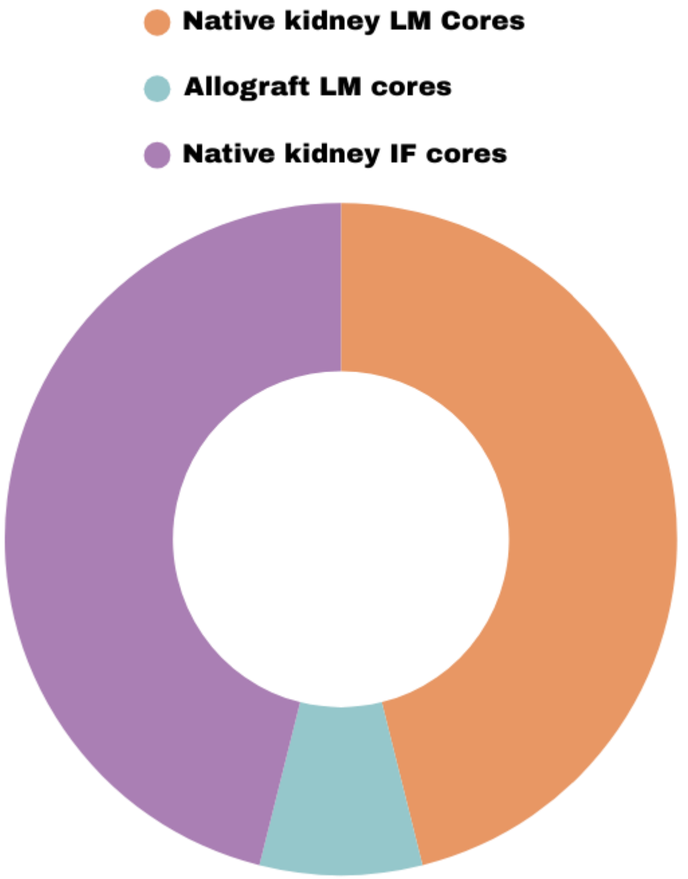
COUNTING THE GLOMERULI





BASELINE CHARACTERISTICS

Baseline Characteristics	Group A	Group B	Group C	Group D
	18G	18G + 20x	16G	16G + 20x
Total number of Cases	214	162	64	171
Total number of Cores	397	301	116	319
Native kidney LM Cores	183	139	52	148
Allograft LM cores	31	23	12	23
Native kidney IF cores	183	139	52	148




RESULTS
RESULTS
RESULTS
RESULTS

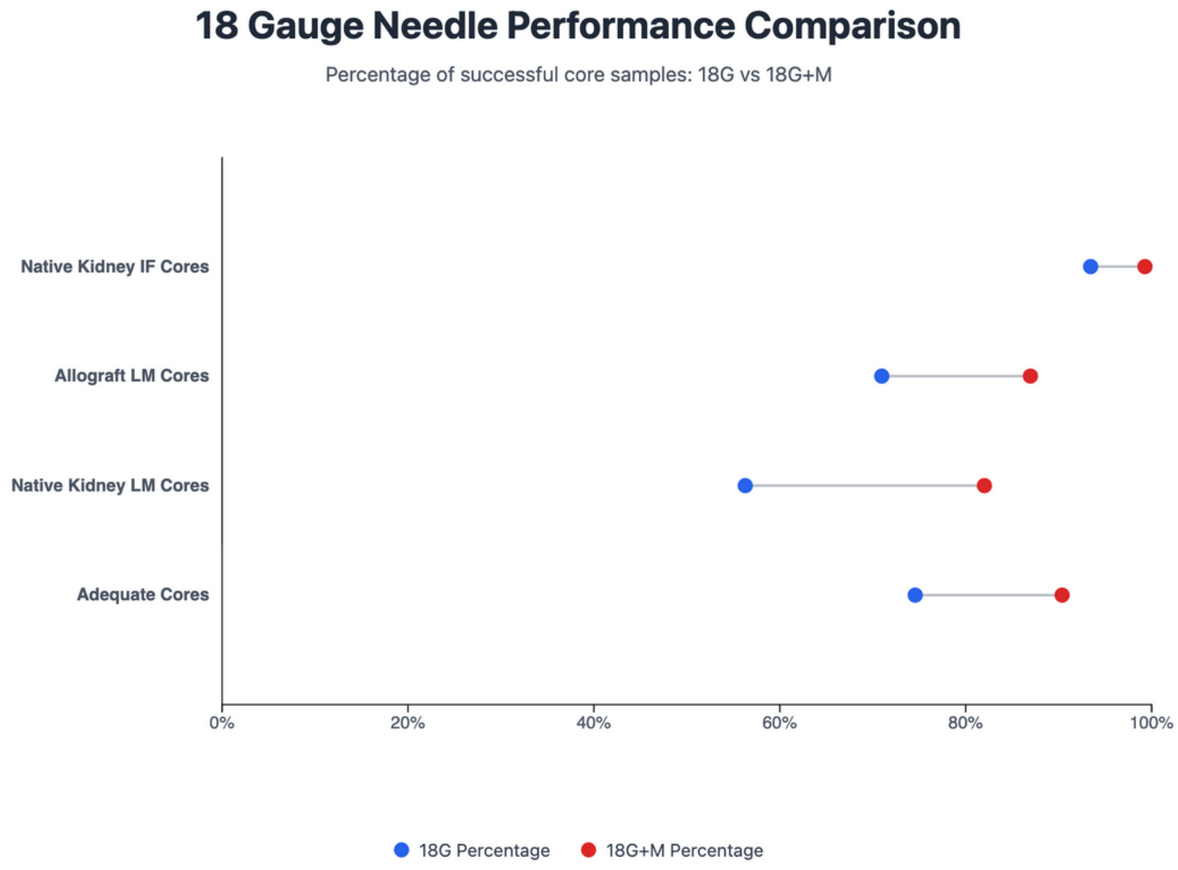
PRIMARY OBJECTIVE

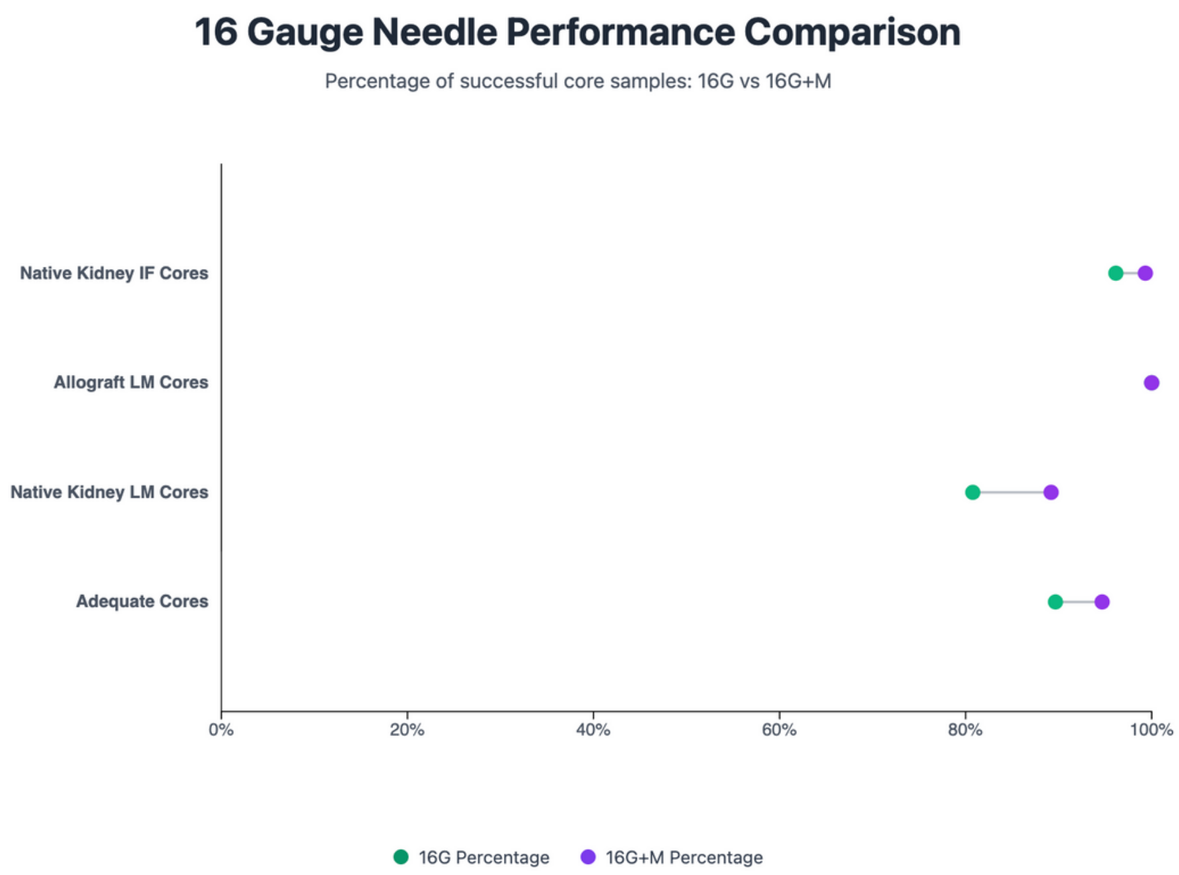
Improvement in Core Adequacy

Characteristic	18 gauge needle comparision				16 gauge needle comparision			
	18G	18G+20x	p-value	odds ratio (CI)	16G	16G+20x	p-value	odds ratio (CI)
Adequate Cores	296/397 (74.56%)	272/301 (90.37%)	**<0.00001**	3.2 (2.05-4.99)	104/116 (89.66%)	302/319 (94.67%)	0.08	2.05 (0.95-4.44)
Native Kidney LM Cores	103/183 (56.28%)	114/139 (82.01%)	**<0.00001**	3.54 (2.10-5.97)	42/52 (80.77%)	132/148 (89.19%)	0.15	1.96 (0.83-4.66)
Allograft LM Cores	22/31 (70.97%)	20/23 (86.96%)	0.2	2.73 (0.65-11.51)	12/12 (100%)	23/23 (100%)	1	NA
Native Kidney IF Cores	171/183 (93.44%)	138/139 (99.28%)	**0.006**	9.68 (1.24-75.40)	50/52 (96.15%)	147/148 (99.32%)	0.29	5.88 (0.52-66.25)

PRIMARY OBJECTIVE

Improvement in Core Adequacy





SECONDARY OBJECTIVE

Rate of Non-Diagnostic Biopsy Cores by Intervention Group

Characteristic	18 gauge needle comparision				16 gauge needle comparision			
	18G	18G+20x	p-value	Odds ratio (CI)	16G	16G+20x	p-value	Odds Ratio (CI)
Total Non-Diagnostic Cores	28/397 (7.05%)	5/301 (1.66%)	**0.001**	4.49 (1.71-11.78)	3/116 (2.59%%)	3/319 (0.94%)	0.17	2.8 (0.56-14.06)
Native Kidney LM Cores	13/183 (7.10%)	3/139 (2.16%)	**0.046**	3.47 (0.97-12.41)	1/52 (1.92%)	2/148 (1.35%)	1	1.43 (0.13-16.12)
Allograft LM Cores	3/31 (9.68%)	1/23 (4.35%)	0.635	2.36 (0.23-24.25)	0/12 (0%)	0/23 (0%)	1	NA
Native Kidney IF Cores	12/183 (6.56%)	1/139 (0.72%)	**0.006**	9.68 (1.24-75.40)	2/52 (3.85%)	1/148 (0.68%)	0.29	5.88 (0.52-66.25)

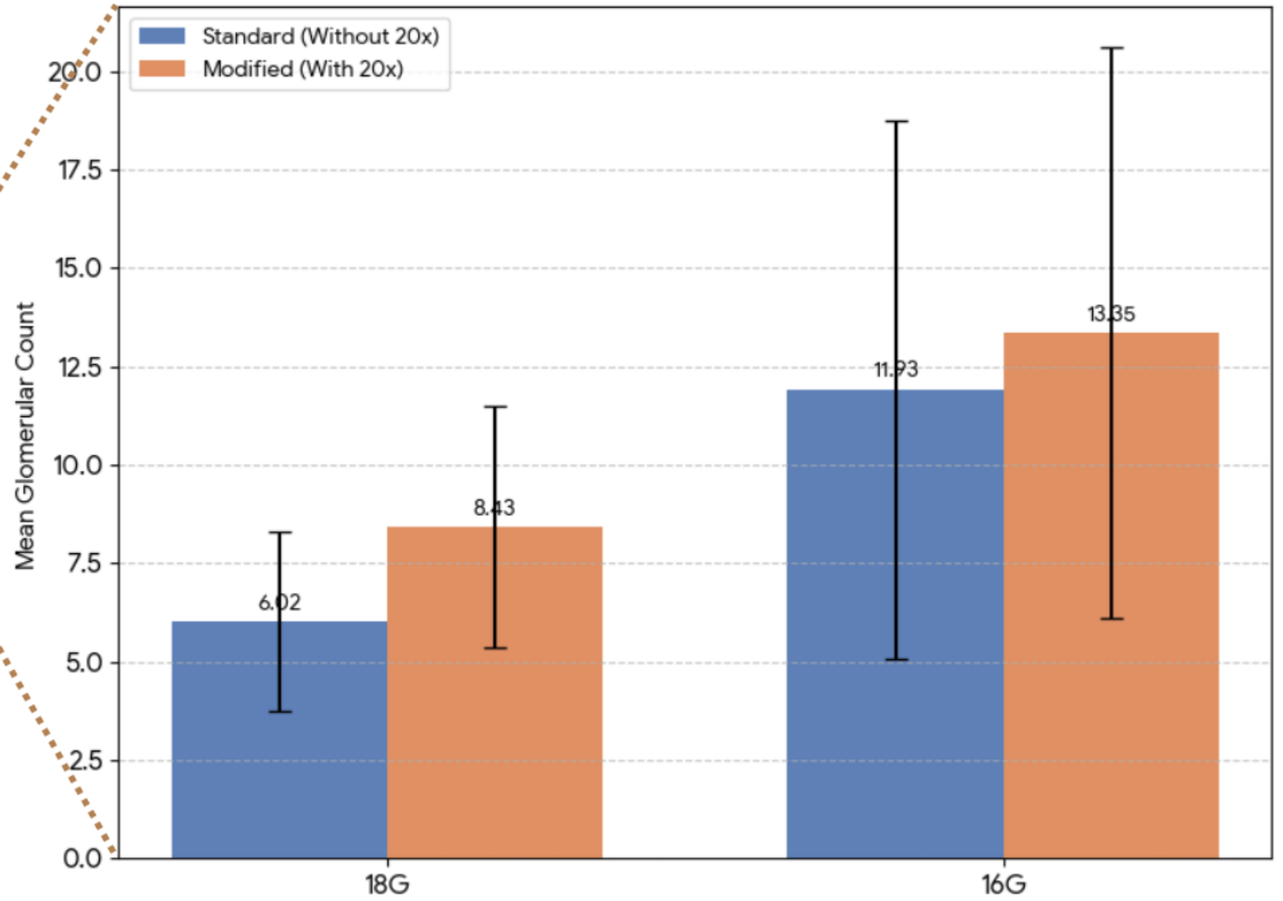
SECONDARY OBJECTIVE

Glomeruli Count - Subgroup analysis - 18G vs 16G

Total Cores	18 G	16 G
Total Cores without 20x	397	116
Total Cores with 20x	301	319

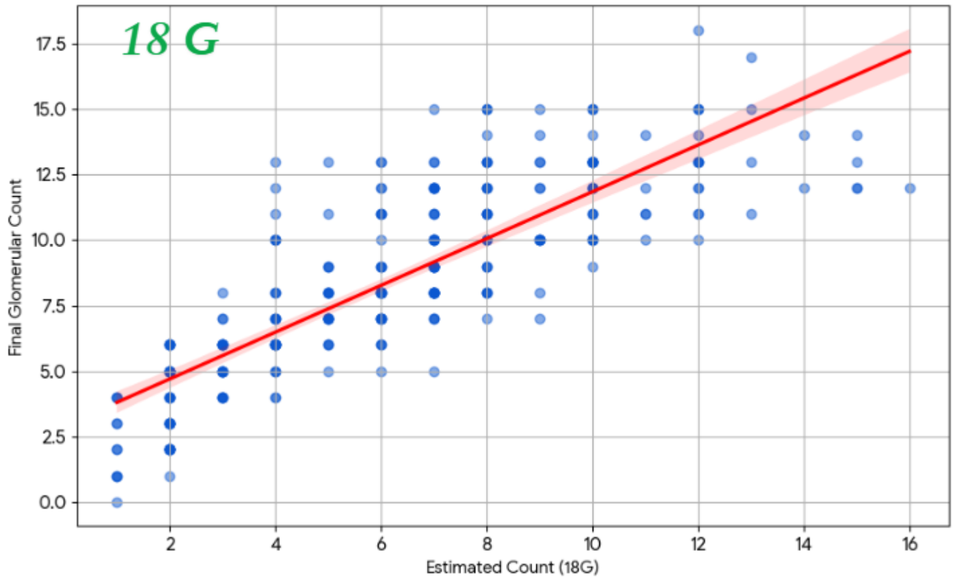
Mean Glomerular Count	without 20x	with 20x	P value
18 G	6.02 ± 2.27	8.43 ± 3.05	<0.0001
16 G	11.93 ± 6.84	13.35 ± 7.26	0.061

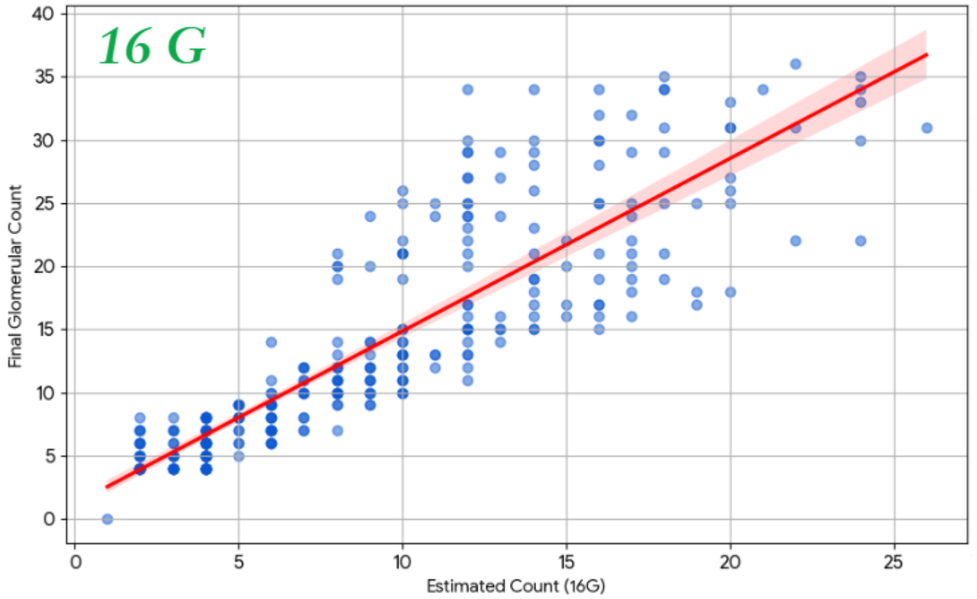
Mean Glomerular Count	18 G	16 G	P value
without 20x	6.02 ± 2.27	11.93 ± 6.84	<0.0001
with 20x	8.43 ± 3.05	13.35 ± 7.26	<0.0001



SECONDARY OBJECTIVE

Estimation of number of Glomeruli



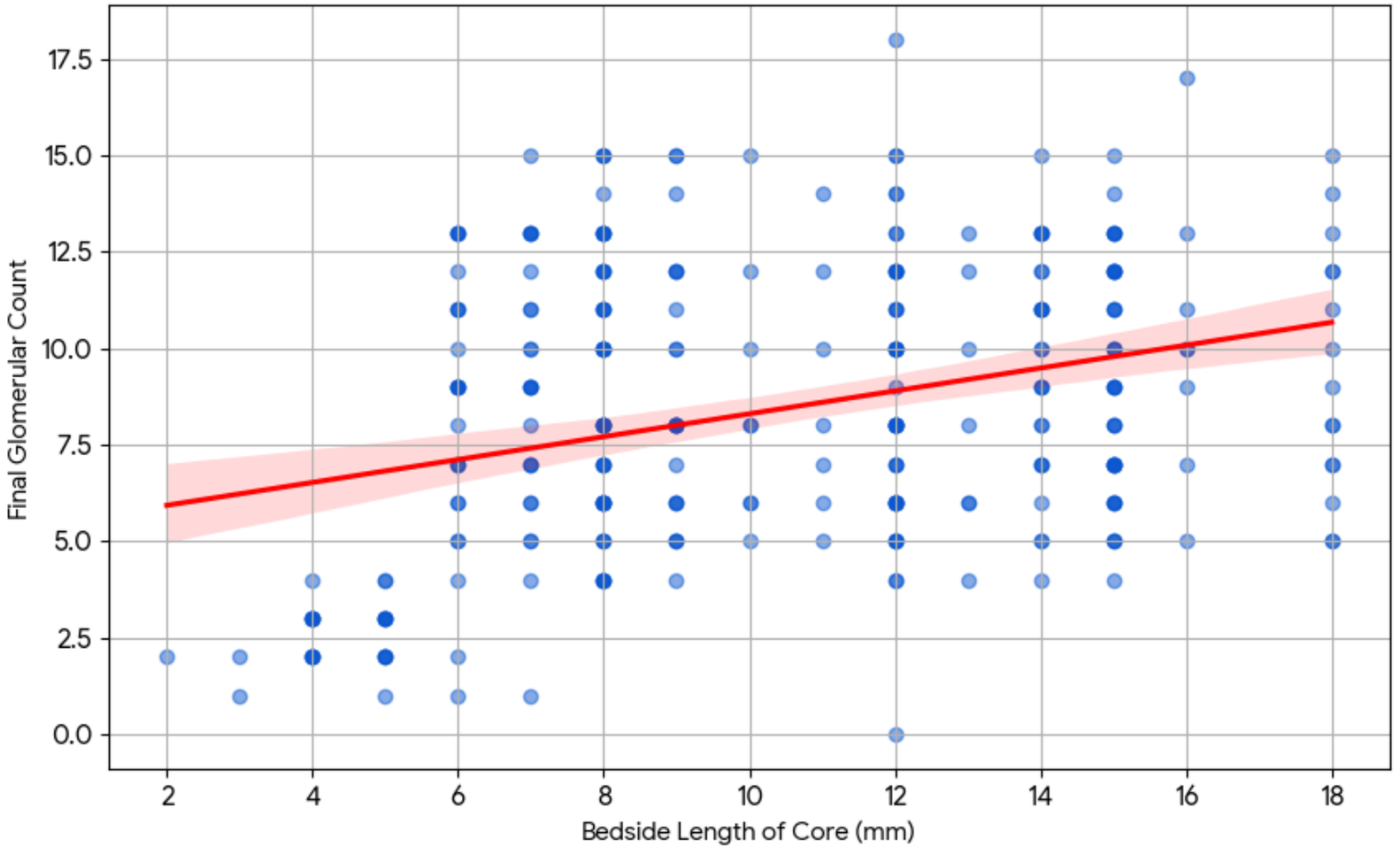


Piersson's coefficient of Correlation	**0.83**
Mean Absolute Error	2.47
Root MSE	3.06
Coefficient of Determination	0.29
Accuracy for minimum glomerulus count	***93.69%***

Piersson's coefficient of Correlation	**0.87**
MAE	4.51
Root MSE	6.46
Coefficient of Determination	0.45
Accuracy for minimum glomerulus count	***97.18%***

SECONDARY OBJECTIVE

Core Length VS Glomeruli Number $r = 0.32$



BEYOND THE

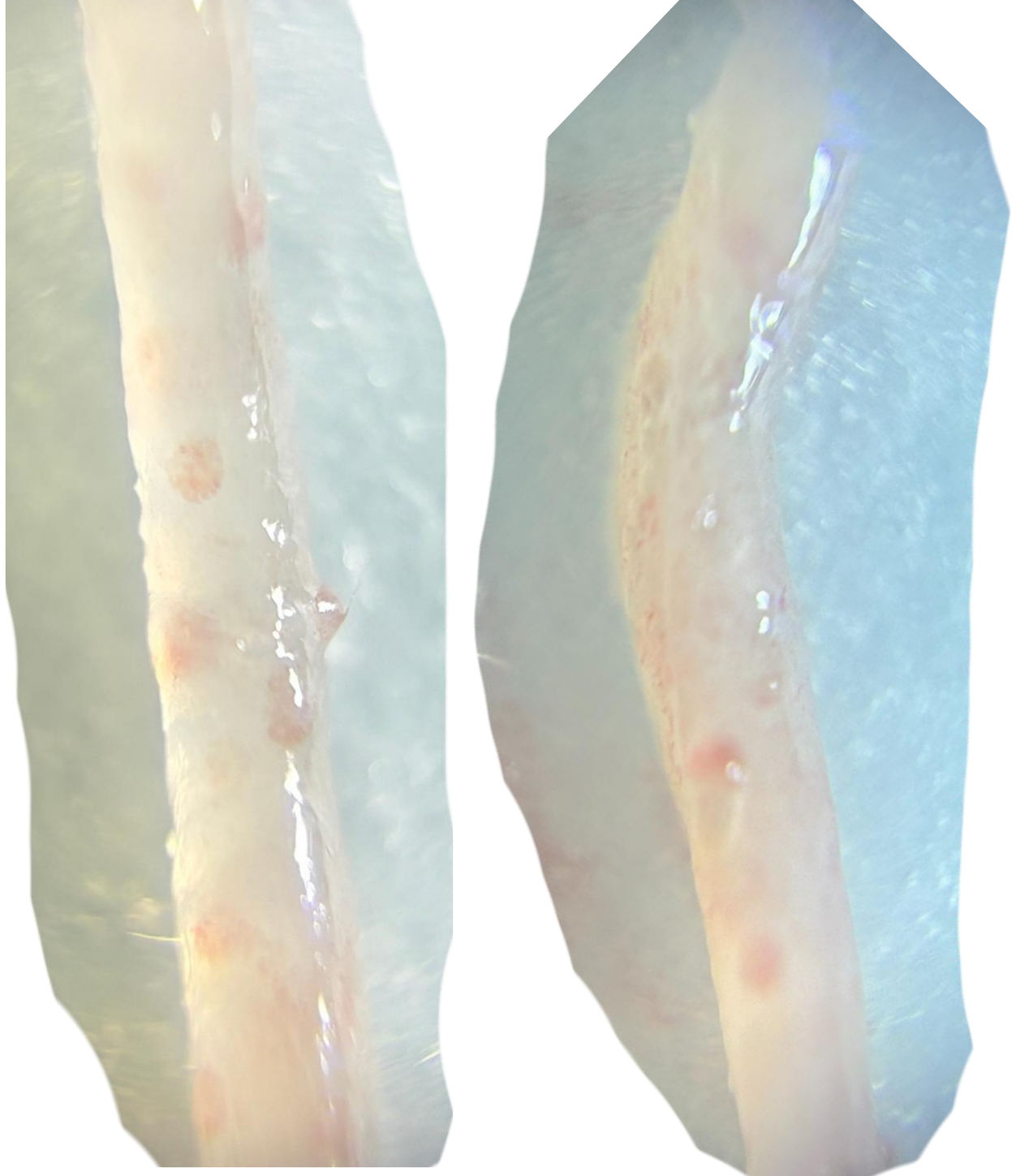
Adequacy

BEYOND THE

Adequacy

ADJUSTING DEPTH OF PASS

- Evaluation of 1st Core ----> Crowded vs Sparse Glomeruli ?
- 2nd Pass depth can be adjusted

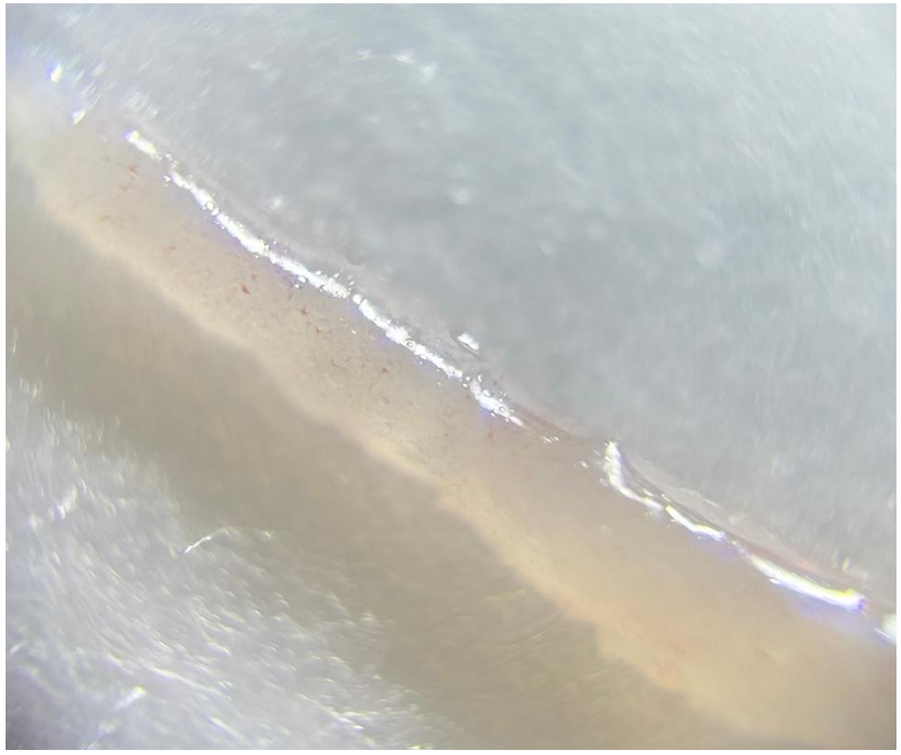


BEYOND THE
Adequacy

SAVING
THE GLOMERULI

Small Core
? FAT
? CORE

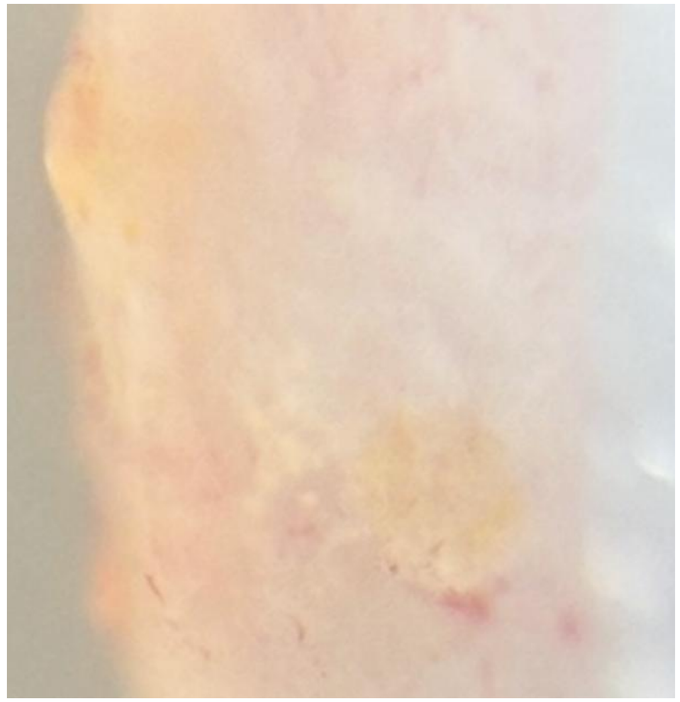
SAVING
THE NEPHROLOGIST

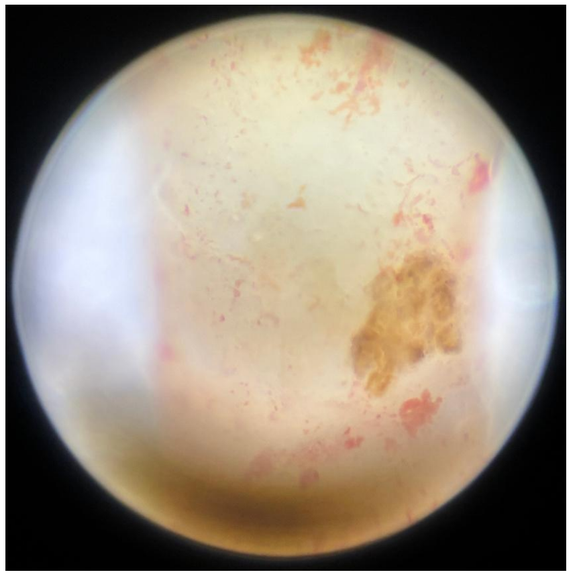


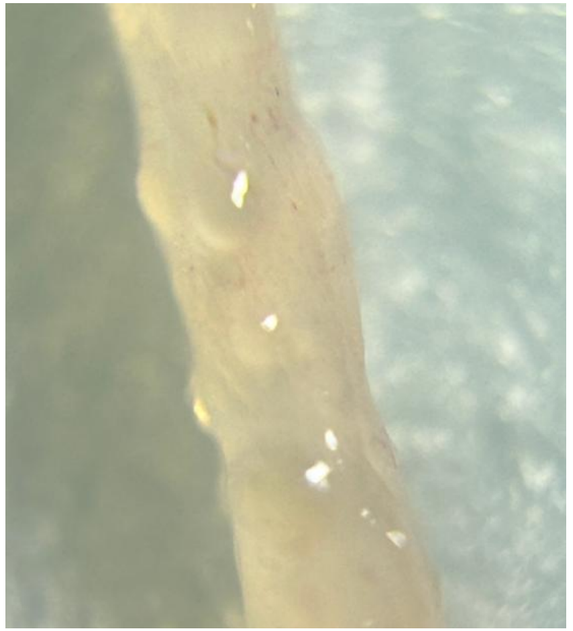
MAY NOT
SINK

BEYOND THE
Adequacy

IDENTIFY CHRONICITY



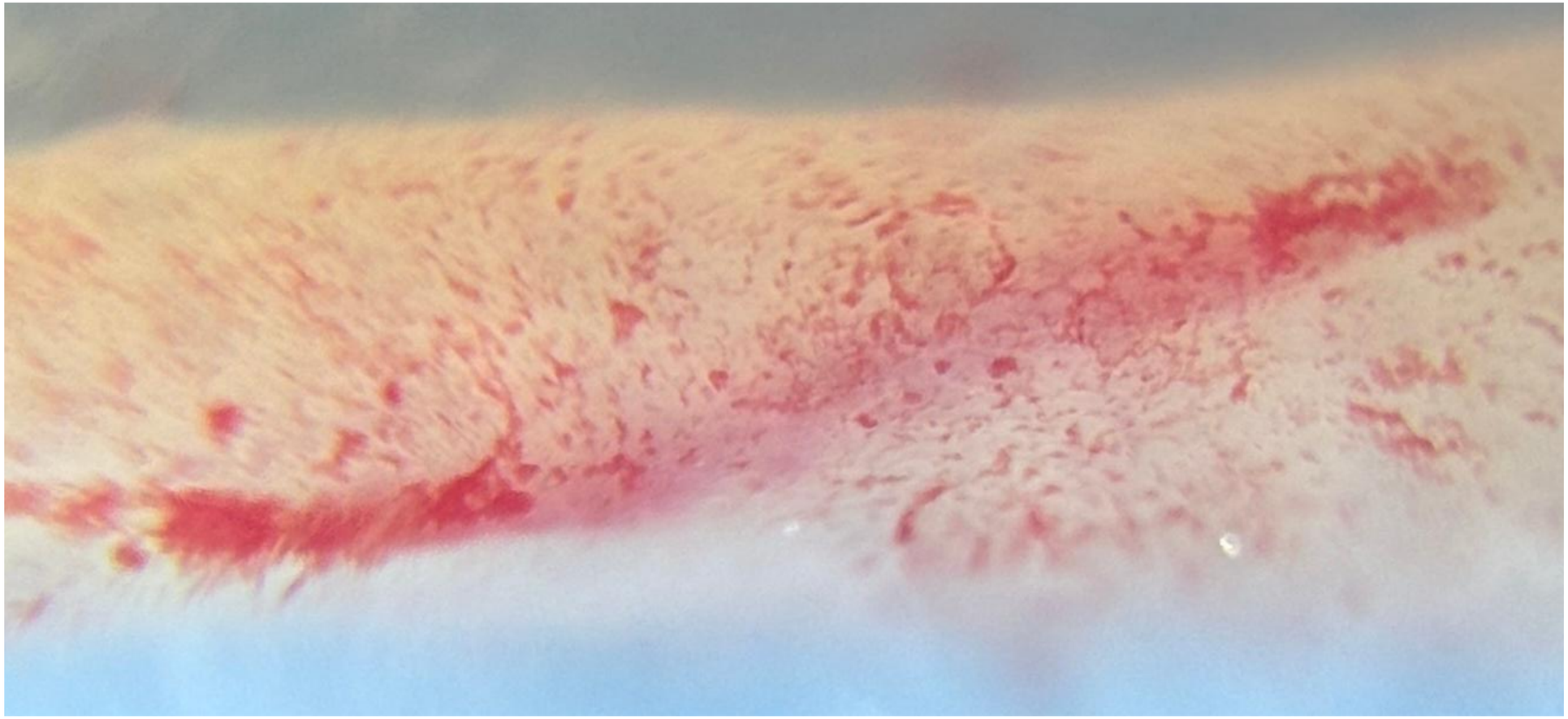




CHRONICITY

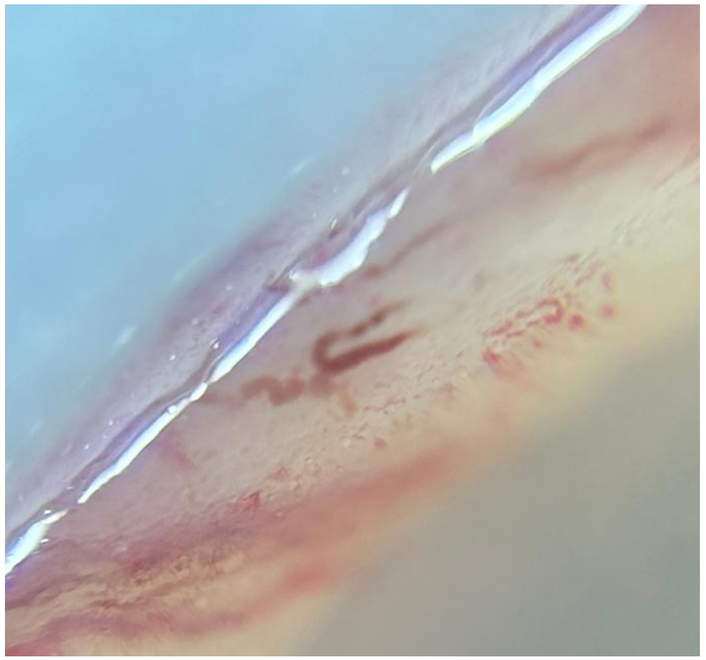
BEYOND THE
Adequacy

ANTICIPATE BLEEDING

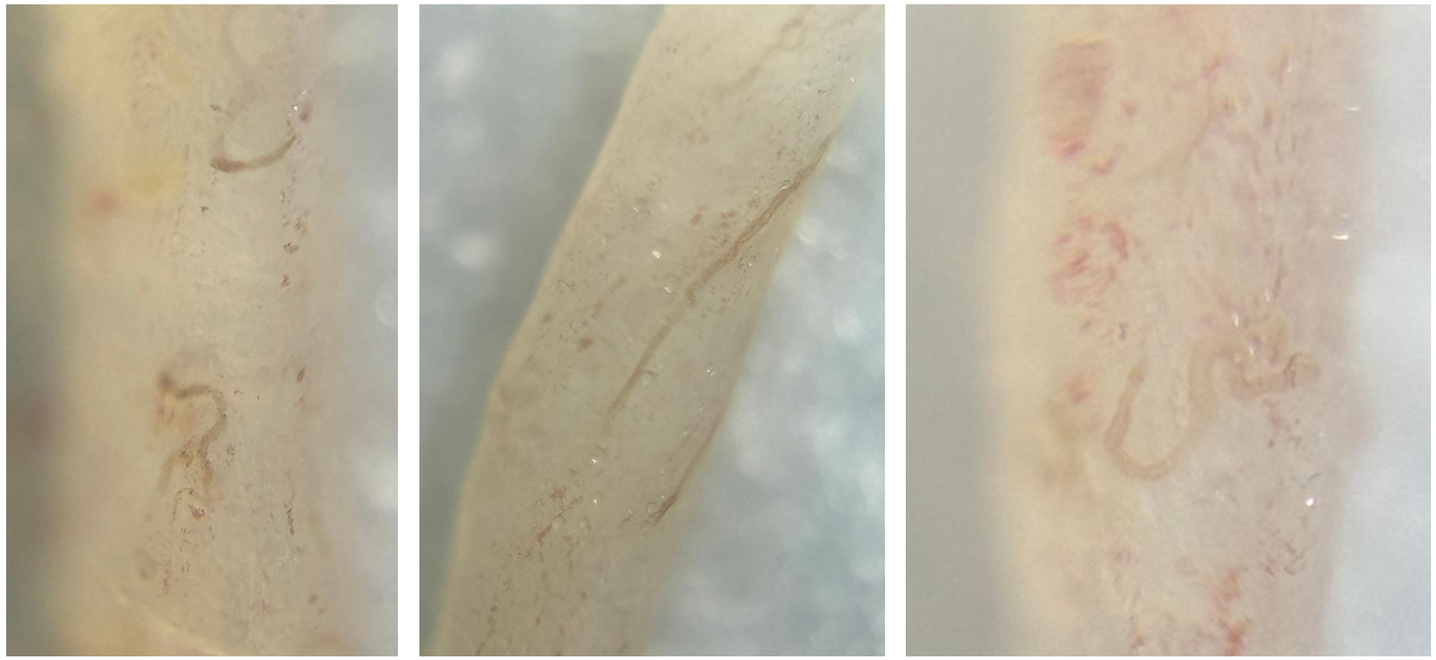


BEYOND THE
Adequacy

POSSIBLE PATHOLOGY



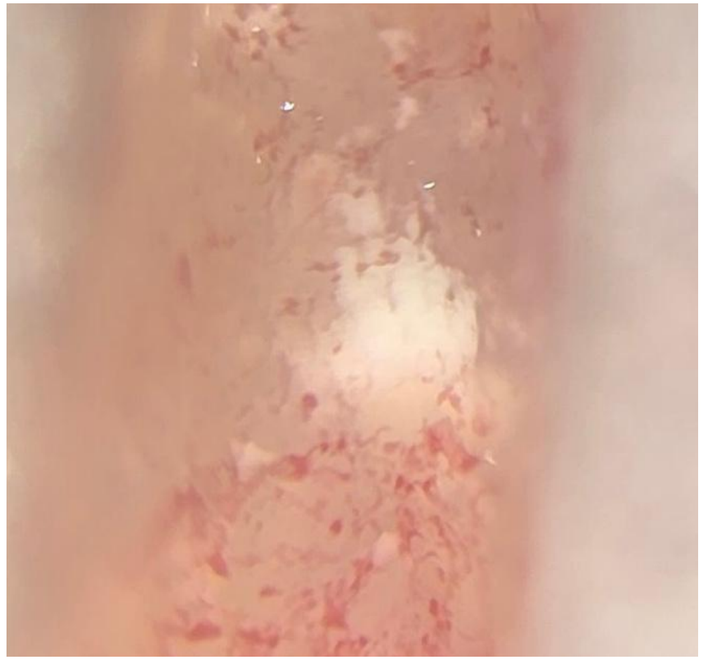
Tubular Injury with dilatation of lumina and flattened lining, few with hyaline casts and occasional ones with RBCs within.



Tubular injury with dilated lumina, flattened and denuded epithelium along with **ropy and pigmented granular casts.**

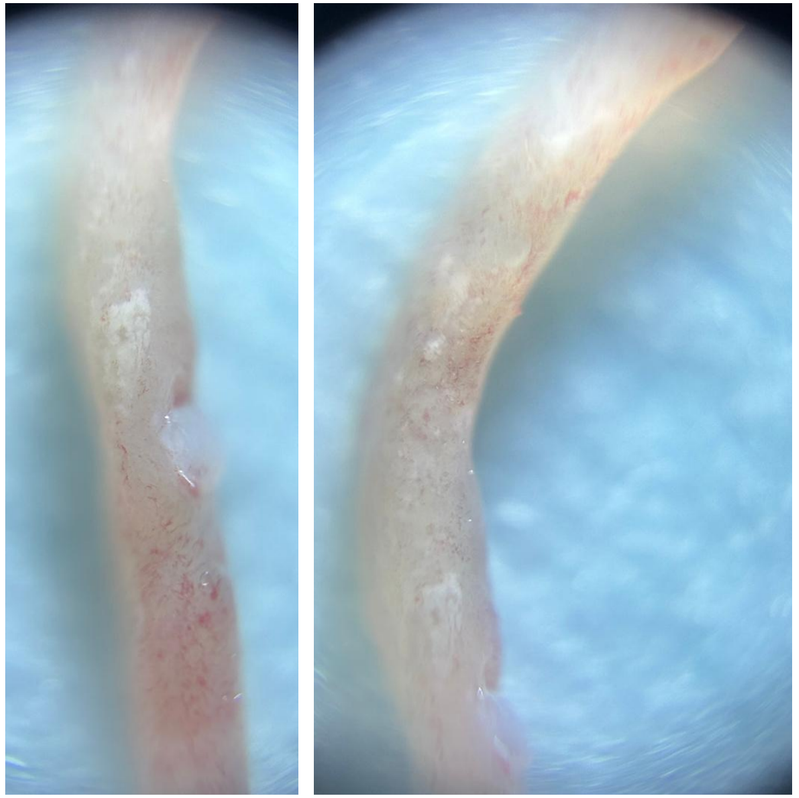
BEYOND THE
Adequacy

POSSIBLE PATHOLOGY



Clusters of **foamy histiocytes** are seen scattered in the interstitium.
Diagnosis - MN

Clusters of **foamy histiocytes**
Diagnosis - MN



Clusters of **foamy histiocytes** are seen
Diagnosis - IgAN

CONCLUSION

The 20x portable microscope significantly enhances renal biopsy adequacy, particularly with 18G needles.

Reliance on core length alone is misleading, whereas glomerular visualization under portable microscope provides a reliable and practical tool to guide adequacy.

Ability to raise the adequacy of biopsies performed with 18G needle to a level comparable with those obtained using the larger 16G needle

Effectively bridging the long-standing gap between procedural safety and diagnostic accuracy.

LIMITATIONS

- No Randomisation (Allocation was based on doctor)

CONFLICT OF INTEREST

- nil

Thank You