

Indu Arun

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Address: Senior Consultant, Department of Pathology, Tata Medical Center, 14 Main Arterial Road (E-W), Newtown, Rajarhat, Kolkata -700160, WB, India.

EDUCATION

MBBS	Medical College, Trichur, Kerala	1999
MD	Medical College Kottayam, Kerala, MD Pathology Thesis: "Morphological types of anemia in adult patients in a teaching hospital in central Kerala with special reference to macrocytic anemia".	2007
PDF	Tata Medical Center, Kolkata, Post doctoral fellowship in Oncopathology	2012

DETAILS OF TRAINING AND EXPERIENCE

July 2012- June 2015	Junior consultant, Department of Histopathology, Tata medical Center Kolkata.
June 2015 - June 2018	Associate consultant, Department of Histopathology, Tata medical Center Kolkata.
June 2018 – present	Senior Consultant, Department of Histopathology, Tata medical Center Kolkata.

- 1994-2000**
Internship
- Undergraduate medical training (MBBS) and 1 year Rotating
- 2004- 2007
- Postgraduate training in Pathology (MD)
- Rotational postings in Histopathology, Hematology, Cytopathology.
 - Weekly Pap smear screening program for early detection of cervical cancer.
 - Pathologic autopsies.
 - Blood banking.
 - Teaching assignments for undergraduate students in Pathology.
- Sept 2006 –Oct 2006
- One month training in immunohistochemistry and immunofluorescence staining techniques and interpretation at Amrita Institute of Medical Sciences, Kochi, India
- Aug 2007-Nov 2007
- Senior resident in Pathology and Diagnostic Services at Government Medical College, Trichur, India.
- Routine histopathology grossing and reporting
 - Performing cytology FNA procedure and reporting.
 - Teaching assignments for undergraduate students.
- Aug 2008 to May 2009
- Research Fellow in Flow Cytometry Lab, National Cancer Institute (NCI), National Institutes of Health, Bethesda, U.S.A.
- Worked in diagnostic Flow Cytometry lab under Dr. Maryalice Stetler- Stevensen and trained in the analysis of clinical flow cytometry data and interpretation in Leukemias and Lymphomas.
 - Underwent hands-on laboratory training in the Principles and Methods of Flow Cytometry conducted by Foundation of Advanced Education in the Sciences, Inc at the National Institutes of Health, U.S.A.
- March -May 2009**
- Observership at Laboratory of Pathology, NCI, and NIH, Bethesda, USA. Attended Hematopathology case discussion and sign out with Dr. Elaine .S. Jaffe

June 2009 to 2010

Senior resident in Pathology and Diagnostic Services at Government Medical College, Trichur, India.

- Routine histopathology grossing and reporting
- Performing cytology FNA procedure and reporting.
- Teaching assignments for undergraduate students

July 2011 to July 2012

Fellowship in Oncopathology in Tata medical Center Kolkata.

- Grossing of oncologic resection specimen and entry of core data elements and pathologic staging as per CAP (College of American Pathologists) protocol.
- Frozen section grossing and reporting under the supervision of consultants.
- Training in reporting small biopsies with appropriate and judicious use of immunohistochemistry to arrive at a diagnosis.
- Onsite adequacy checking of cytology FNA (guided and unguided) and reporting.

MEMBERSHIPS :

Indian Association of Pathology and Microbiology (IAPM).

The International Academy of Pathology - Indian Division (IAP-ID)

Publications :

1. **Arun I**, Roy P, Jain PV, Hameed S, Manikantan K, Arun P. Subcategorization of Perineural Invasion and Its Impact on Survival in Patients with Oral Squamous Cell Carcinoma. Head Neck Pathol. 2023 Jun;17(2):383-392.

2. Acs B, Leung SCY, Kidwell KM, **Arun I**, Augulis R, Badve SS, Bai Y, Bane AL, et al; International Ki67 in Breast Cancer Working Group of the Breast International Group and North American Breast Cancer Group (BIG-NABCG). Systematically higher Ki67 scores on core biopsy samples compared to corresponding resection specimen in breast cancer: a multi-operator and multi-institutional study. *Mod Pathol*. 2022 Oct;35(10):1362-1369. doi: 10.1038/s41379-022-01104-9.
3. **Arun I**, Venkatesh S, Ahmed R, Kumar Agrawal S, Leung SCY. Reliability of Ki67 visual scoring app compared to eyeball estimate and digital image analysis and its prognostic significance in hormone receptor positive breast cancer. *APMIS*. 2021 May 30. doi: 10.1111/apm.13156. Epub ahead of print. PMID: 34053140.
4. **Arun I**, Maity N, Hameed S, Jain PV, Manikantan K, Sharan R, Arun P. Reply to Letter to the Editor regarding "Lymph node characteristics and their prognostic significance in oral squamous cell carcinoma". *Head Neck*. 2021 May 8. doi: 10.1002/hed.26711. Epub ahead of print. PMID: 33964180.
5. **I Arun**, S Hameed. Clear cell carcinoma of salivary gland - A diagnostic challenge. *Indian Journal of Medical Research* 2020; 152: 215-6.
6. 1.Roy P, Mallick I, **Arun I**, Zameer L, Dey D, Singh A, Chatterjee S, Jain P, Manikantan K, Sharan R, Pattathayil A. Nodal yield and topography of nodal metastases from oral cavity squamous cell carcinoma - An audit of 1004 cases undergoing primary surgical resection. *Oral Oncol*. 2020 Dec 16;113:105115. doi: 10.1016/j.oraloncology.2020.105115. Epub ahead of print. PMID: 33341004.
7. Kathrotiya, M, Radhakrishnan, VS, Bhave, S, J Kumar, Roychowdhury M, **Arun I** et al. Relapsed plasmablastic lymphoma in a HIV-negative patient: Pushing the envelope. *Clin Case Rep*. 2020; 00: 1– 5. <https://doi.org/10.1002/ccr3.3673>
8. **Arun I**, Maity N, Hameed S, Jain PV, Manikantan K, Sharan R, Arun P. Lymph node characteristics and their prognostic significance in oral squamous cell carcinoma. *Head Neck*. 2020 Oct 6. doi: 10.1002/hed.26499. Epub ahead of print. PMID: 33021340
9. Tewary S, **Arun I**, Ahmed R, Chatterjee S, Mukhopadhyay S. AutoIHC-Analyzer: computer-assisted microscopy for automated membrane extraction/scoring in HER2 molecular markers. *J Microsc*. 2021 Jan;281(1):87-96. doi: 10.1111/jmi.12955. Epub 2020 Aug 27. PMID: 32803890.
10. Agrawal SK, Hashlamoun I, Karki B, Sharma A, **Arun I**, Ahmed R. Diagnostic Performance of Indocyanine Green Plus Methylene Blue Versus Radioisotope Plus Methylene Blue Dye Method for Sentinel Lymph Node Biopsy in Node-Negative Early Breast Cancer. *JCO Glob Oncol*. 2020 Jul;6:1225-1231. doi: 10.1200/GO.20.00165. PMID: 32749861; PMCID: PMC7456319.
11. Dutta A, Arun P, **Arun I** (corresponding author). Adenoid Cystic Carcinoma with Transformation to High Grade Carcinomatous and Sarcomatoid Components: A Rare Case Report with Review of Literature. *Head Neck Pathol*. 2020 Dec;14(4):1094-1104. doi: 10.1007/s12105-019-01120-3. Epub 2020 Jan 2. PMID: 31898057; PMCID: PMC7669942.
12. Jain PV, Sharan R, Manikantan K, Mallick I, Chatterjee S, **Arun I**, Arun P. Clinicopathologic Determinants of Outcome in Pathologic T4a (pT4a) Squamous Cell Carcinoma of the Gingivobuccal Subsite of the Oral Cavity. *Indian J Surg Oncol*. 2019 Dec;10(4):594-599.

doi: 10.1007/s13193-019-00950-5. Epub 2019 Jun 27. PMID: 31857749; PMCID: PMC6895327.

13. Agrawal SK, Bansawal L, **Arun I**, Datta SS, Chatterjee S, Ahmed R. Sentinel Lymph Node Biopsy After Initial Lumpectomy (SNAIL Study)-a Prospective Validation Study. *Indian J Surg Oncol*. 2019 Jun;10(2):350-356. doi: 10.1007/s13193-018-0861-4. Epub 2018 Dec 18. PMID: 31168261; PMCID: PMC6527719
14. Ankit Kumar Patel, Kavya Vipparthi, Venu Thatikonda, Indu Arun, Samsiddhi Bhattacharjee, Rajeev Sharan, Pattatheyl Arun & Sandeep Singh; A subtype of cancer-associated fibroblasts with lower expression of alpha-smooth muscle actin suppresses stemness through BMP4 in oral carcinoma. *Oncogenesis* **7**, 78 (2018).
<https://doi.org/10.1038/s41389-018-0087-x>
15. A. Choraria, S. Agrawal, **I. Arun**, S. Chatterjee, and R. Ahmed ; Sentinel and Non-Sentinel Lymph Node Metastasis Prediction and Validation of the MSKCC Nomograms for Indian Breast Cancer Patients *Journal of Global Oncology* 2018 4:Supplement 2, 35s-35s
16. Leung SCY, Nielsen TO, Zabaglo LA, Arun I, Badve SS et al. Analytical validation of a standardized scoring protocol for Ki67 immunohistochemistry on breast cancer excision whole sections: an international multicenter collaboration. *Histopathology*. 2019 Apr 24. doi: 10.1111/his.13880. [Epub ahead of print]
17. Dutta A, Arun P, Roy P, **Arun I (corresponding author)**. Cytological diagnosis of follicular dendritic cell sarcoma: A case report and review of literature. *Cytopathology*. 2018;00:1–7.
18. **Arun I**, Roy P, Arora N, Bhawe SJ, Nair R, Chandy M. PAX-5 Positivity in Anaplastic Lymphoma Kinase-Negative Anaplastic Large Cell Lymphoma: A Case Report and Review of Literature. *Int J Surg Pathol*. 2017 Jun;25(4):333-338. doi: 10.1177/1066896916683447. Epub 2016 Dec 26.
19. Banerjee S, Saha M, **Arun I**, Basak B, Agarwal S, Ahmed R, Chatterjee S, Mahanta LB, Chakraborty Near-set Based Mucin Segmentation in Histopathology Images for Detecting Mucinous Carcinoma *C.J Med Syst*. 2017 Aug 10; 41(9):144.
20. .Pal, R., Bhaumik, J. & **Arun, I**. Endodermal sinus tumour of uterine cervix- A case report *Indian J Gynecol Oncolog* (2017) 15: 38.
21. Saha M, **Arun I**, Basak B, Agarwal S, Ahmed R, Chatterjee S, Bhargava R, Chakraborty C. Quantitative microscopic evaluation of mucin areas and its percentage in mucinous carcinoma of the breast using tissue histological images. *Tissue Cell*. 2016 Jun; 48(3):265-73.
22. T Mungle, S Tewary, **I Arun**, B Basak, S Agarwal, R Ahmed, S Chatterjee, Automated characterization and counting of Ki-67 protein for breast cancer prognosis: A quantitative immunohistochemistry approach- Computer methods and programs in biomedicine 139, 149-161
23. T Mungle, S Tewary, DK Das, **I Arun**, B Basak, S Agarwal, R Ahmed et al MRF-ANN: a machine learning approach for automated ER scoring of breast cancer immunohistochemical images :*Journal of microscopy* 267 (2), 117-129
24. S Tewary, **I Arun**, R Ahmed, S Chatterjee, C Chakraborty AutoIHC scoring: a machine learning framework for automated Allred scoring of molecular expression in ER and PR stained breast cancer tissue *Journal of microscopy* 268 (2), 172-185

25. S Tewary, **I Arun**, R Ahmed, S Chatterjee, C Chakraborty ,SmartIHC-Analyzer: smartphone assisted microscopic image analytics for automated Ki-67 quantification in breast cancer evaluation *Analytical Methods* 9 (43), 6161-6170
26. Saha M, Arun I , Agarwal S, Ahmed R, Chatterjee S, Chakraborty C Imprint cytology-based breast malignancy screening: an efficient nuclei segmentation technique. *J Microsc.* 2017 Nov;268(2):155-171. doi: 10.1111/jmi.12595.
27. Monjoy Saha, Chandan Chakraborty, Indu Arun, Rosina Ahmed & Sanjoy Chatterjee An Advanced Deep Learning Approach for Ki-67 Stained Hotspot Detection and Proliferation Rate Scoring for Prognostic Evaluation of Breast Cancer *Scientific Reports* volume 7, Article number: 3213 ,2017
28. Sanjoy Chatterjee, **Indu Arun**, Sanjit Agrawal, Moses Arunsingh, Indranil Mallick, Rosina Ahmed, Immunohistochemistry Heterogeneity in Reported Breast Cancer Demographics From India: Triple-Negative Breast Cancer Rates Could Be Lower Than Suggested in Pooled Meta-Analysis DOI: 10.1200/JGO.2016.006635 *Journal of Global Oncology* - published online before print October 28, 2016
29. Samuel CY Leung , Torsten O Nielsen , Lila Zabaglo , **Indu Arun** , Sunil S Badve , Anita L Bane , John MS Bartlett , Signe Borgquist , Martin C Chang , Andrew Dodson , Rebecca A Enos , Susan Fineberg, Cornelia M Focke, Dongxia Gao , Allen M Gown, Mitch Dowsett etal on behalf of the International Ki67 in Breast Cancer Working Group of the Breast International Group and North American Breast Cancer Group (BIG-NABCG) Analytical validation of a standardized scoring protocol for Ki67: phase 3 of an international multicenter collaboration. *npj Breast Cancer* (2016) 2, 16014;
30. Chatterjee S, Arunsingh M, Agrawal S, Dabkara D, Mahata A, **Arun I**, Shrimali RK, Achari R, Mallick I, Ahmed R. Outcomes Following a Moderately Hypofractionated Adjuvant Radiation (START B Type) Schedule for Breast Cancer in an Unscreened Non-Caucasian Population. *Clinical Oncology*.
31. Sanjit Agrawal , Lalit Banswal, Animesh Saha, **Indu Arun**, Soumitra Shankar Datta, Sanjoy Chatterjee, Rosina Ahmed Progesterone Receptors, Pathological Complete Response and Early Outcome for Locally Advanced Breast Cancer – a Single Centre Study. (PPLB – 01) *Indian Journal of Surgical Oncology* First online: 23 April 2016
32. Sanjoy Chatterjee, Animesh Saha, **Indu Arun**, Sonali Susmita Nayak, Subir Sinha, Sanjit Agrawal, Mayur Parihar, Rosina Ahmed .Correlation of clinicopathological outcomes with changes in IHC4 status after NACT in locally advanced breast cancers: do pre-NACT ER/PR status act as better prognosticators? *Breast Cancer* (Dove Med Press) 2015; 7: 381–388. Published online 2015 December 10. doi: 10.2147/BCTT.S94516 PMCID: PMC4677657
33. Sancheti S, Menon S, Mukherjee S, **Arun I**. Clear cell renal cell carcinoma with hemangioblastoma-like features: A recently described pattern with unusual immunohistochemical profile. *Indian J Pathol Microbiol.* 2015 Jul-Sep;58(3):354-5. doi: 10.4103/0377-4929.162898.
34. Chatterjee G, DasGupta S, Mukherjee G, Sengupta M, Roy P, **Arun I**, Datta C, Mishra PK, Banerjee S, Chatterjee U. Usefulness of Wieneke criteria in assessing morphologic characteristics of adrenocortical tumors in children. *Pediatr Surg Int.* 2015 Jun;31(6):563-71. doi: 10.1007/s00383-015-3708-x. Epub 2015 Apr 17.

35. Sancheti SM, Midha D, Zameer MA, **Arun I**. Benign monsters. *Int J Surg Pathol*. 2015 May;23(3):207-8. doi: 10.1177/1066896915576405. Epub 2015 Mar 17.
36. Nandi M, **Arun I**, Bhattacharya A, Sen S, Ray S, Mallick I. Reporting of a primary sinonasal neuroendocrine small cell carcinoma in the paediatric age group. *Head Neck Oncol* 2014 May 03;6(1):5.
37. Arora N, **Arun I**, Chakrapani A, Nair R. Classical Hodgkin lymphoma with coexistent plasma cell neoplasm: A case report. *Indian J Pathol Microbiol* 2014;57:656-8
38. Kumar P, Parveen A, Das A, Raychaudhury T, **Arun I**. Solitary asymptomatic papule on cheek . *Indian J Dermatol Venereol Leprol* 2014;80:481-2
39. Ghosh I, **Arun I**, Sen S, Mishra L. Metastatic perivascular epithelioid cell tumor responding to mammalian target of rapamycin inhibition. *Indian J Med Paediatr Oncol* 2014;35: 99-102
40. Jasper GA, **Arun I**, Venzon D, Kreitman RJ, Wayne AS, Yuan CM, Marti GE, Stetler-Stevenson M. Variables affecting the quantitation of CD22 in neoplastic B cells. *Cytometry Part B* 2011;80B: 83–90.
41. **Arun I**, Wulu JA, Janik JE, Jasper GA, Yuan CM, Venzon D, Stetler-Stevenson M. Visual inspection versus quantitative flow cytometry to detect aberrant CD2 expression in malignant T cells. *Cytometry Part B* 2010; 78B: 169–175.
42. **Indu PS**, Poothode U, Augustine J, Pillai SB. Thanatophoric dysplasia: a case report and review of literature. *Indian J Pathol Microbiol*. 2007 Jul;50(3):589-92. Review.

Invited lectures, case and poster presentations:

1. Attended ACORD workshop 2018, from 9th to 14th September at Magenta-NSW/Australia.
2. Best of SABCS India 2018 at India habitat Centre, Lodhi Road, Delhi. on 21/04/2018 – Speaker, Topic -HER2 testing - 2017 guidelines for HER2 testing.
3. Pre EBM CME Recent Advances Head and Neck Pathology Topic presented - Interesting case presentation- Ewing sarcoma/PNET of salivary gland.
4. CME on Breast Pathology Update 2017, at College of Medicine and Sagore Dutta Hospital, Kolkata on 12/08/2017, Presentation in a panel discussion on molecular biology of breast cancer.
5. Decoding Breast Cancer A recap of the Milan Breast Cancer Conference on 19/08/2017, Jehangir Breast Care Center, Presentation of a case as a part of breast cancer MDT team
6. Participated in Acord Workshop on 06/09/2017, at Tata Medical Center.
7. First annual update in lymphoma on 28 th October, organized by Tata Memorial Hospital, Mumbai presented a case of EBV positive DLBCL, NOS.

8. APCON 2017, Preconference workshop and CME, 6th December 2017, Pot – Pourri of interesting cases Head and neck cancer at Gandhi Medical College, Bhopal –Presented a rare case of Adenoid cystic carcinoma salivary gland with high grade transformation into a sarcoma.

9. Lymphoma Update 2016 essentials and beyond- Rajiv Gandhi Cancer Institute and Research Centre, New Delhi, 14 th March 2016 Presented a case of PAX-5 Positive Anaplastic Large Cell Lymphoma, A Diagnostic Dilemma"

10. Controversies in Clinical Oncology on 23/07/2016 by Department of radiotherapy TMC Kolkata .Topic - Don't do IHC if you don't know its pitfalls. IHC-4- when can you believe the results. Better to have the unknown than incorrect answers!! Pathologists challenges

11. 3rd Indo-British Advanced MasterClass in Breast Oncoplastic course , by International School of Oncoplastic Surgery, Pune in collaboration with Senior Surgeons of University of East Anglia, UK and Association of Breast Surgeons, UK on 06/08/2016 at Hotel Conrad, Pune Topic: Presented cases as part of multidisciplinary breast cancer team, TMC Kolkata.

12. Lymphoma Meet 2016, – TATA Medical Center, Kolkata, 17/09/2016 Topic : Mantle cell lymphoma diagnostic pitfalls.

13. Workshop on “Autoimmune/drugs/viruses related lymphadenopathies / lymphoid proliferations” on 08/11/2016 , Hemacon 2016, at SDMH Santokhba Durlabjee Medical Hospital Auditorium, Jaipur, Presented a case of - EBV positive mucocutaneous ulcer.

14. The 2nd NordiQC Conference on Applied Immunohistochemistry June 9 th to June 12 th 2015, at Aalborg University Hospital, Denmark, Poster presentation: Expression of immunohistochemical markers in locally advanced breast carcinoma and their use as predictors of pathological response.

15. APCON 2015 at Le Meridien Kochi, Kerala, on 5 th December 2015- Presented a poster - Lymph Node Ratio in the Prognosis of Squamous Cell Carcinoma of the Oral Cavity.

16. Breast pathology update 2014, IPGMER, 08/05/2014, Presented few interesting cases.

17. Cure Thyroid 27h March, 2015, Head and Neck surgery department, TMC Kolkata - Presented Bethesda system of classification of thyroid cancers.

Awards:

1. Best Poster Award for presentation titled Thanatophoric dysplasia: A Pathologist's perspective, at Thiruvananthapuram at the annual meeting of Indian Association of Pathologists and Microbiologists- Kerala. August, 2005.

2. Awarded Union for International Cancer Control (UICC) technical fellowship Title: “Streamlining Pathology Inputs for Optimisation of Cost, Time and Quality in the Conduct of

Clinical Trial” at Addenbrookes Hospital, Cambridge, United Kingdom in January 2023, Life
Member of the Association of UICC Fellows