PATHOLOGICA 2025;117:366-373
DOI: 10.32074/1591-951X-N1281

Original article

Current approaches, barriers, and future directions in pleural mesothelioma diagnostics: results from an Italian National Survey

Federica Pezzuto[1], Gianluca Lopez[2,3], Francesca Barbisan[4], Lorenzo Rosso[3,5], Giuseppe Pelosi[6], Mauro Papotti[7], Luisella Righi[8], Fiorella Calabrese[1]

[1] Department of Cardiac, Thoracic, Vascular Sciences, and Public Health, University of Padova, University Hospital of Padova, Padova, Italy; [2] Department of Biomedical, Surgical and Dental Sciences, University of Milan, Milan, Italy; [3] Fondazione IRCCS Ca' Granda - Ospedale Maggiore Policlinico, Milan, Italy; [4] AOU delle Marche, Ancona, Italy; [5] Department of Pathophysiology and Transplantation, University of Milan, Milan, Italy; [6] Department of Oncology and Hemato-Oncology, University of Milan, Milan, Italy; [7] Department of Oncology, University of Turin, City of Health and Science, Turin, Italy; [8] Department of Oncology, University of Turin, San Luigi Hospital, Orbassano (Turin), Italy

Summary

Objective. This nationwide survey aimed to assess current diagnostic practices, adherence to international guidelines, and challenges encountered by Italian pathologists in the diagnosis of diffuse pleural mesothelioma (PM).

Methods. A structured questionnaire with 38 items was distributed electronically via Google Forms to Italian pathologists involved in mesothelioma diagnosis. Questions covered demographics, biopsy practices, pathology report, immunohistochemistry, molecular diagnostics, educational needs, and barriers to collaborative research.

Results. Participants represented diverse experience levels and institutional affiliations, primarily academic medical centers. Significant variability was found in tissue sampling and biobanking practices. Major diagnostic challenges included identifying sarcomatoid/desmoplastic patterns and inadequate adipose tissue in biopsies. Most pathologists managed inconclusive cases via multidisciplinary discussions and molecular analyses (BAP1, MTAP). Barriers identified included inadequate digital pathology infrastructure and limited standardized protocols for tissue collection. Participants strongly favored enhanced molecular resources, standardized histopathological protocols, and national collaborative initiatives.

Conclusions. Improved diagnostic accuracy requires targeted training, standardized protocols, enhanced molecular diagnostic capabilities, and structured national collaborations.

Key words: pleural mesothelioma, histopathology, diagnostic practices, immunohistochemistry, molecular biomarkers

Received: April 29, 2025
Accepted: July 5, 2025

Correspondence
Federica Pezzuto
E-mail: federica.pezzuto@unipd.it

How to cite this article: Pezzuto F, Lopez G, Barbisan F, et al. Current approaches, barriers, and future directions in pleural mesothelioma diagnostics: results from an Italian National. Pathologica 2025;117:366-373 https://doi.org/10.32074/1591-951X-N1281

Introduction

Diffuse pleural mesothelioma (PM) is an aggressive malignancy predominantly associated with asbestos exposure, characterized by high mortality rates and limited therapeutic options [1]. Accurate histopathological diagnosis is crucial, particularly in the current era of evolving therapeutic strategies. Mesothelioma is histologically classified into epithelioid, sarcomatoid, and biphasic subtypes, each associated with distinctive prognostic outcomes and responses to treatments [1]. Historically, treatment strategies for mesothelioma have involved multimodal approaches, typically combining chemotherapy, radiation therapy, and surgery, such as

extrapleural pneumonectomy or pleurectomy/decortication, particularly in selected cases of epithelioid histology [2]. However, recent advances in immunotherapy, especially the introduction of immune checkpoint inhibitors, have reshaped the therapeutic landscape for all mesothelioma subtypes. In the landmark CheckMate 743 trial, nivolumab plus ipilimumab significantly improved survival compared to conventional chemotherapy in patients with unresectable mesothelioma, with sarcomatoid and biphasic subtypes showing particular benefit [3]. While international trials have demonstrated benefit of immunotherapy across all mesothelioma histotypes, national regulatory approvals vary. In Italy, dual immunotherapy with nivolumab and ipilimumab is currently approved in the first line setting for the non-epithelioid subtype. Ongoing efforts to integrate immunotherapy into early-stage pleural mesothelioma treatment include several neoadjuvant and perioperative clinical trials. The CHIMERA trial (NCT06155279) is a multicenter Phase II study evaluating the safety, feasibility, and resection rate after induction therapy with pembrolizumab combined with platinum-pemetrexed chemotherapy in epithelioid and biphasic mesothelioma. A separate Phase II multicenter trial (SWOG S1619/NCT03869766) is investigating neoadjuvant atezolizumab alongside cisplatin and pemetrexed, demonstrating tolerability and logistical feasibility, with encouraging early survival results. Meanwhile, the window-of-opportunity Phase II trial (NCT02592551) randomized patients to either neoadjuvant single-agent durvalumab or combined durvalumab + tremelimumab before surgery, observing favorable immunologic modulation and safety. For the particularly aggressive sarcomatoid subtype, the Alliance A082101 study (NCT05094851) is assessing neoadjuvant ipilimumab plus nivolumab, aiming to determine surgical feasibility and 12-month progression-free survival. This significant advancement anticipates the need for detailed histopathological characterization of epithelioid mesotheliomas, a heterogeneous group that includes a broad spectrum of morphological, molecular, and immunological features [4]. Precise characterization of these features, such as tumor-associated necrosis, PD-L1 expression, immune cell infiltration patterns, and molecular alterations like BAP1 and MTAP loss, has increasing relevance not only for accurate diagnosis, but also for predicting immunotherapy responsiveness and patient prognosis [1,5,6].

Despite clear guidelines and the expanding therapeutic options, real-world practice often reveals substantial variability and persistent diagnostic challenges. Limited biopsy material, inconsistent use of immunohistochemical panels, and difficulties in accurately classifying subtle sarcomatoid components within predominantly epithelioid tumors remain notable barriers [1,7]. Addressing these challenges is critical because histological characterization directly affects clinical decision-making, influencing therapeutic eligibility and ultimately patient outcomes [8].

Given these considerations, a survey was conducted to comprehensively explore current diagnostic practices among pathologists involved in mesothelioma diagnosis. The survey specifically aims to document how pathologists' approach histotype categorization, apply immunohistochemical and molecular markers in routine practice, and overcome complexities introduced by rapidly evolving treatment strategies, especially immunotherapy. The ultimate goal is to highlight existing diagnostic variability, identify specific educational needs, and promote adherence to international guidelines.

Materials and methods

Study Design and Objectives

This study used a cross-sectional, survey-based approach designed to assess the current practices, challenges, and educational needs among pathologists involved in the diagnosis of PM. The primary aim of the survey was to evaluate diagnostic approaches, adherence to international diagnostic guidelines, and the practical integration of immunohistochemical and molecular techniques in routine pathology workflows. The survey was intentionally limited to PM due to its higher incidence, its well-established national pathology network (GIPP), and the availability of more standardized diagnostic frameworks. Extra-pleural mesotheliomas, such as peritoneal or pericardial forms, were excluded from this analysis, as they represent a separate and heterogeneous group with distinct clinical and pathological characteristics, warranting a dedicated study approach.

Survey Instrument Development

The survey questionnaire was developed and validated by an expert panel of pathologists specializing in thoracic pathology to ensure its relevance and reliability. It included 38 structured and semi-structured questions covering various aspects of PM diagnostics and related practices (Supplementary file 1). Specifically, 5 questions addressed demographic and institutional information, including participants' geographic region, level of experience, and type of institution. Methods of pleural tissue sampling and sample characteristics were explored through 6 questions, while 10 questions focused on the diagnostic workflow, par-

ticularly the use of immunohistochemical and molecular techniques. Challenges in diagnosing PM, with emphasis on handling inconclusive cases, were examined through 7 questions. Additionally, 6 questions assessed practices related to the collection of supplementary material for research and biobanking, while 4 questions investigated case-sharing practices among colleagues and institutions. Finally, educational and training aspects, along with resource availability, were addressed in the remaining questions.

Survey Distribution and Participant Selection

The survey was distributed electronically via Google Forms through the mailing list of the *Gruppo Italiano di Patologia Pleuropolmonare* (GIPP), affiliated with the *Società Italiana di Anatomia Patologica e Citologia Diagnostica* (SIAPEC). It was sent to 100 pathologists specializing or regularly involved in PM diagnosis from various Italian institutions. Participants were given 7 weeks to complete the survey.

The invitation email clearly described the survey's objectives, estimated duration (10 minutes), and emphasized the voluntary nature of participation. Completing the survey implied participant consent for anonymized analysis and publication of the data for research purposes.

Data collected from the survey were analyzed using descriptive statistics. Categorical responses were summarized using absolute frequencies and percentages. Open-ended responses underwent thematic analysis to identify common challenges and practices, with illustrative quotes extracted to complement quantitative findings.

Given the anonymous and voluntary nature of the survey, ethical approval was not required. Participants provided implicit informed consent through survey completion. All data were treated confidentially and analyzed anonymously.

Results

A total of 55 pathologists from various Italian institutions participated in the survey (Fig. 1), providing detailed responses regarding current diagnostic practices, challenges, and educational needs in PM. The median response time from the questionnaire administration was 10 days. Participants represented a diverse range of experience levels and institutional settings, ensuring broad representativeness of the collected data.

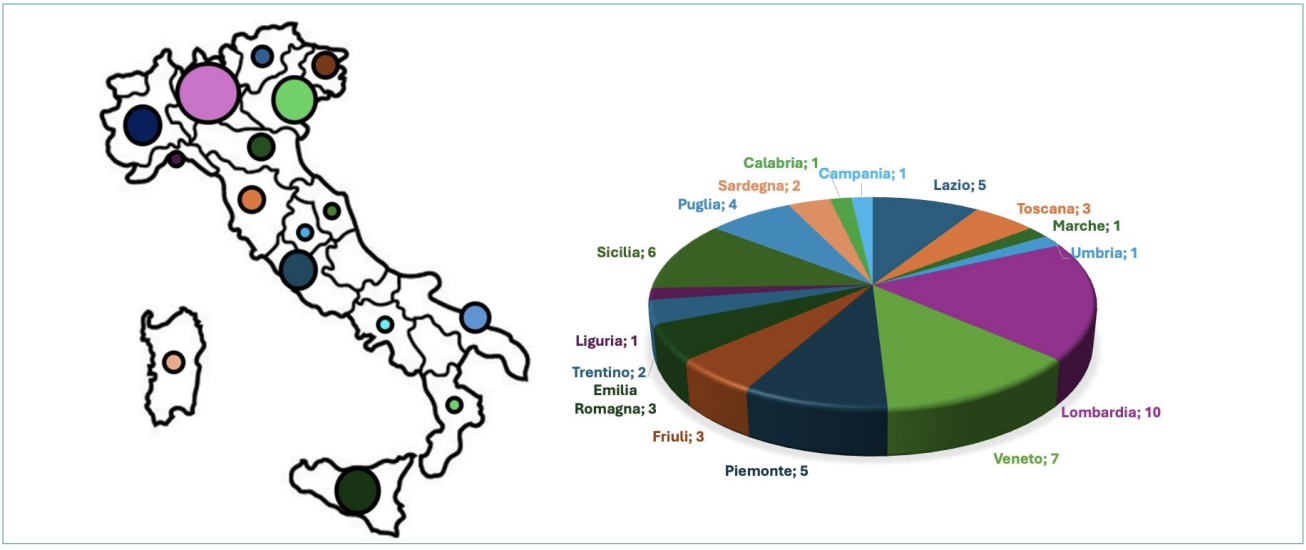

Figure 1. Geographic distribution of pathologists participating in the mesothelioma survey.

Demographics and Institutional Details

The survey included pathologists practicing across multiple Italian regions, representing diverse levels of professional experience. Of those who participated, 36.4% reported more than 20 years of pathology experience, while 23.6% indicated 11-20 years, and 25.5% had between 5-10 years of practice. A smaller proportion (14.5%) had fewer than 5 years of experience. Most participating pathologists (58.2%) were affiliated with academic medical centers, whereas the remainder practiced within community hospitals or private diagnostic centers, thus reflecting a representative cross-section of mesothelioma diagnostic settings (Tab. I).

Regarding diagnostic volume, the majority of partici-

Table I. Summary of participant demographics.

Characteristics	Participants (N)	Percentage (%)
Experience		
Less than 5 years	8	14.5
5-10 years	14	25.5
11-20 years	13	23.6
More than 20 years	20	36.4
Type of Institution		
Academic Medical Center	32	58.2
Community Hospital	21	38.2
Private Diagnostic Center	1	1.8
IRCSS	1	1.8

pants reported regular involvement in PM diagnostics. Specifically, 45.5% stated they encounter 5-25 PM cases per year, 30.9% manage 25-50 cases annually, and 3.6% see over 50 cases yearly. Only 20% of respondents reported diagnosing PM rarely (fewer than 5 cases per year).

Pleural Tissue Sampling Practices

Survey data showed consistent patterns in pleural biopsy procedures. Thoracic surgeons were primarily responsible for obtaining biopsy samples in most institutions. Multiple biopsy samples, typically three or more, were usually received for histological assessment (Tab. II). The largest diameter of these samples most commonly ranged from 1-2 cm (56.4%), though a smaller proportion typically received samples of 0.5-1 cm (38.2%). Fibroadipose tissue was frequently reported within biopsy samples, providing essential histological context for invasion evaluation. Annotation of the anatomical site from which biopsies were obtained was consistently performed in most institutions (Tab. II).

Table II. Pleural tissue sampling details.

Sampling Characteristics	Participants (N)	Percentage (%)
Professional Responsible		
Thoracic Surgeon	36	65.5
Pulmonologist Thoracic surgeon and/or pulmunologist	5 13	9.1 23.6
Pathologist	1	1.8
Number of Samples per Case		
1-2 samples	22	40
3-4 samples	17	30.9
≥5 samples	16	29.1
Average Sample Size		
- < 0.5 cm	2	3.6
- 0.5-1 cm	21	38.2
- 1-2 cm	31	56.4
Variable size	1	1.8
Fibroadipose Tissue Presence		
- Yes	49	89.1
- No	6	10.9
Anatomical Site Specified		
- Always	44	80
- Sometimes/Never	11	20

Research and Biobanking Practices

Institutional practices varied significantly regarding the collection and storage of additional biological materials, such as pleural effusions or fresh tissue samples, for biobanking and research purposes. A minority of institutions (25.9%) engaged regularly in these biobanking practices, while the majority (74.1%) did not routinely collect additional research materials. Commonly reported barriers included insufficient infrastructure and the absence of standardized institutional protocols, factors potentially limiting translational research capabilities and biomarker discovery.

Diagnostic Challenges in Mesothelioma

Major diagnostic challenges identified in the survey included difficulties in accurately recognizing sarcomatoid and desmoplastic patterns, particularly within limited biopsy material. The frequent absence of adequate adipose tissue in specimens further complicated the reliable assessment of invasion. Additionally, while all cases require integration of morphology and a standard immunohistochemical panel, selected difficult cases, particularly those involving the sarcomatoid subtype, may benefit from additional markers. For example, GATA3 can aid in the differential diagnosis with sarcomatoid carcinomas, especially when conventional mesothelial markers are inconclusive. In borderline or poorly differentiated tumors, molecular tools may also provide crucial diagnostic and prognostic support (Tab. III).

Table III. Challenges and difficulties in mesothelioma diagnosis.

Diagnostic Challenges	Participants (N)	Percentage (%)
Difficulty identifying sarcomatoid/ desmoplastic pattern	16	29.1
Lack of adipose tissue complicating invasion assessment	14	25.5
Differentiation between mesothelioma subtypes	9	16.4
Limited availability of clinical/exposure data	8	14.5
Inadequate biopsy material	8	14.5

Histopathological, Immunohistochemical, and Reporting Practices

Pathologists universally used calretinin (100%), while widely other mesothelial markers included WT1 (98.2%), D2-40 (72.7%), and CK5/6 (67.3%) (Fig. 2). In contrast, mesothelin was infrequently used (7.3%). BAP1 immunohistochemistry was routinely applied by 90.9% of pathologists, reflecting its recognized diagnostic value, with the majority (92.7%) rating its importance as significant or very high. However, routine inclusion of BAP1 and MTAP results in pathology reports was less widespread (78.2%). MTAP immunohistochemistry, indicating *CDKN2A* gene deletion, was used by 30.9% of institutions, while p16 FISH was used less frequently (23.6%). Moreover, despite the widespread inclusion of immunohistochemistry results in final reports (98.2%), fewer institutions utilize standardized reporting checklists for diagnoses (54.5%) or consistently report tumor grading (60%). When clinical, radiological, and histological assessments yielded inconclusive results, multidisciplinary discussions and ancillary molecular analyses (particularly BAP1 and MTAP immunohistochemistry) were common strategies, employed by 78.6% of pathologists (Fig. 2).

Educational Needs and Sources of Knowledge

Scientific journals, professional conferences, and collaborative interactions with colleagues were primary sources of continuing education for pathologists. However, the need for enhanced training was expressed frequently, particularly concerning emerging immunohistochemical markers and molecular diagnostic methods (Fig. 3). Addressing these educational gaps is critical for optimizing diagnostic accuracy. Strong interest in sharing mesothelioma cases for consultative, educational, and research purposes was also evident (65.5% very willing, 27.3% somewhat willing). Nonetheless, barriers were occasionally identified, including logistical challenges associated with paraffin-block

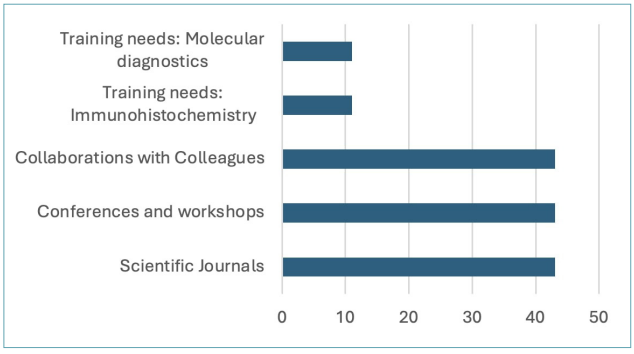

Figure 3. Sources of continuing education and identified training needs in mesothelioma diagnostics among Italian pathologists. Participants could select more than one answer; therefore, percentages reflect the proportion of participants indicating each item.

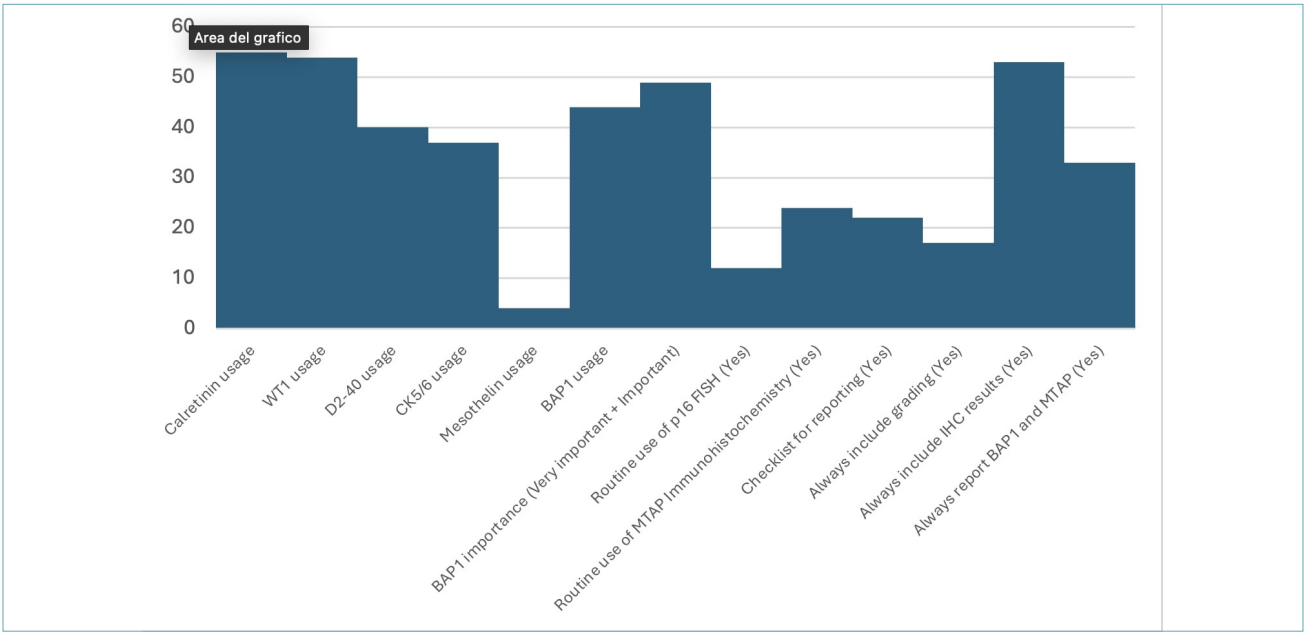

Figure 2. Histological and molecular practices in mesothelioma diagnostics.

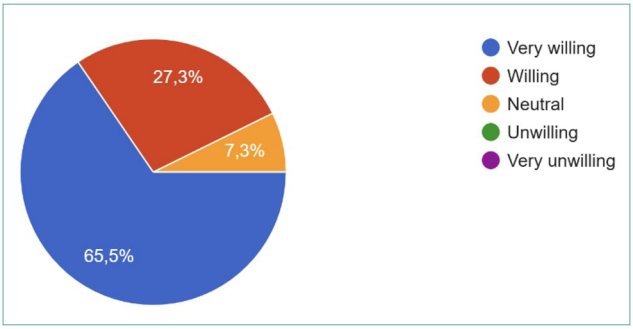

Figure 4. Willingness to collaborative sharing of mesothelioma cases among pathologists.

transport (1.8%). No significant barriers regarding digital pathology infrastructure were noted.
Several opportunities for improvement emerged, notably expanded availability of molecular diagnostics, such as next-generation sequencing and predictive biomarker assays. Additional recommendations included implementing standardized grading and subclassification protocols as well as fostering national collaborations through shared case repositories, multicenter studies, and specialized working groups.

Discussion

This nationwide survey provides a comprehensive snapshot of current diagnostic practices for PM among pathologists across Italy. Our findings highlight significant variability in adherence to recommended diagnostic protocols, reflecting differences in institutional infrastructure, available resources, and personal expertise among practicing pathologists. Participants demonstrated a diverse range of experience levels and institutional affiliations, with the majority operating within academic medical centers.
This is further supported by the diagnostic volume data, which revealed that most participants evaluate between 5 and 50 cases of pleural mesothelioma per year, with a smaller subset diagnosing more than 50 annually. This confirms that the survey predominantly captured responses from pathologists with consistent exposure to mesothelioma diagnostics, adding strength to the validity and representativeness of the findings. However, substantial variability remains in sampling practices, such as the number of biopsies collected and specimen size, which may directly impact diagnostic accuracy and treatment decisions.
Despite this, considerable room for improvement remains in case standardization, educational training, and diagnostic reproducibility. Strategies to enhance knowledge and facilitate case sharing must be urgently addressed both nationally and internationally. At the national level, reinforcing the educational and collaborative activities of the GIPP is essential. It could serve as a formal platform for developing digital case archives, consensus meetings, virtual slide exchanges, and interdisciplinary webinars focused on challenging or rare cases. The implementation of a centralized digital repository and participation in national digital tumor boards would also allow broader access to expert consultation, particularly for low-volume or non-academic centers.
Internationally, alignment with existing initiatives by the International Mesothelioma Panel, International Association for the Study of Lung Cancer (IASLC), and European Society of Pathology (ESP) working groups can promote harmonization of criteria and stimulate transnational case discussions. The adoption of telepathology platforms, structured reporting templates, and cloud-based whole slide imaging tools would enable real-time consultation and training beyond institutional boundaries. Furthermore, establishing shared registries and biorepositories in collaboration with international consortia would support both diagnostic excellence and translation\nal research.
These findings are particularly relevant in the context of evolving treatment paradigms, including recent approval of immunotherapy agents, such as nivolumab and ipilimumab, across all histological subtypes, including the epithelioid component.[4] Precise histotype classification, accurate recognition of sarcomatoid and desmoplastic features, and careful assessment of morphological and molecular heterogeneity have thus become increasingly critical [1,7]. Diagnostic challenges highlighted by participants, including difficulty in recognizing subtle sarcomatoid patterns and distinguishing mesothelioma subtypes, align with previous literature and underscore the need for targeted education and standardized diagnostic protocols.
A significant barrier identified in the survey was the limited infrastructure for sharing paraffin-embedded samples and inadequate digital pathology resources. These barriers restrict opportunities for external consultation and multidisciplinary collaboration, which are essential in cases with inconclusive clinical and histological findings.
The widespread routine use of classic immunohistochemical markers, notably calretinin, WT1, D2-40, and CK5/6, underscores robust adherence to international guidelines [1,9] and reflects a well-established diagnostic practice among Italian pathologists. The high proportion of participants who regularly use BAP1 immunohistochemistry and acknowledge its importance highlights its strong acceptance as a reliable marker for distinguish malignant mesothelioma from benign

mesothelial proliferations [1,10,11]. However, the incomplete universal reporting of BAP1 and MTAP results indicates variability in institutional practices, suggesting a potential gap in guideline adherence or availability of resources. Encouraging uniform reporting practices for these crucial biomarkers is essential to enhance diagnostic consistency, as already established by the International Collaboration on Cancer Reporting (ICCR) and also endorsed by the Società Italiana di Anatomia Patologica e Citologia (SIAPEC) [12].

Variability in reporting practices, particularly the limited adoption of standardized reporting checklists [12] and inclusion of grading[1], may negatively impact diagnostic consistency and comparability among Institutions. Establishing national standards for mesothelioma reporting, possibly with structured templates or checklists, could significantly enhance diagnostic quality and facilitate clinical research [13,14].

The moderate use of MTAP immunohistochemistry suggests that, despite its recognized clinical value, practical challenges such as antibody availability, technical workflow, interpretation difficulties, or limited familiarity might impede its widespread adoption [1,15,16]. Similarly, the lower adoption rate of p16 FISH may reflect resource limitations or uncertainties regarding its added diagnostic value, indicating the need for further validation studies or targeted educational efforts [17].

Institutional variability in biobanking and research sample collection practices was another critical issue, attributed primarily to insufficient resources or lack of established protocols. Addressing these limitations by developing certified biobanks and standardized collection processes would significantly enhance translational research capabilities and facilitate future biomarker discovery [18].

To mitigate the identified challenges, several practical interventions are needed. Enhancing institutional investment in digital pathology and telepathology platforms would facilitate more effective case-sharing and collaborative diagnosis. Additionally, broadening access to molecular diagnostic tools, such as NGS panels, and providing targeted training programs focused on novel immunohistochemical markers would enable pathologists to achieve greater diagnostic precision and consistency in guideline adherence. Moving forward, prospective collaborative studies, ideally multicentric, should be prioritized to validate emerging molecular biomarkers predictive of immunotherapy response and prognosis. Further research focusing on digital pathology integration, standardized reporting frameworks, and the application of artificial intelligence techniques in histopathology could significantly improve diagnostic reliability and therapeutic decision-making.

Conclusions

Addressing the diagnostic variability and barriers identified by this survey requires collaborative, resource-focused interventions, systematic training initiatives, and embracing technological advancements in digital and molecular pathology. Such collective efforts can significantly improve the accuracy of mesothelioma diagnosis and clinical management, benefiting patients through more personalized and effective therapeutic approaches. Future studies could expand this approach to include extra-pleural mesotheliomas, which remain underinvestigated and would benefit from greater diagnostic standardization and collaborative study.

Acknowledgements

The authors would like to thank all pathologists who participated in this survey for generously sharing their valuable insights and professional experiences.

Conflicts of interest statement

The authors declare no conflict of interest.

Funding

The authors did not receive any funding for this study.

Authors' contributions

FP contributed to the conceptualization of the study, methodology development, survey design, data analysis, manuscript drafting, critical revision for important intellectual content, and supervision; GL contributed to the survey design, data analysis, interpretation of findings, and critical review of the manuscript; FB participated in survey dissemination, data collection, interpretation of findings, and manuscript review; LRo supported the clinical contextualization of results, particularly regarding surgical biopsy practices, and reviewed the manuscript; GP and MP supervised the survey design, critically interpreted histopathological and molecular data, and reviewed the manuscript for intellectual content; LRi validated the survey content, critically evaluated diagnostic challenges in mesothelioma, and contributed to the manuscript writing and review; FC conceptualized and led the project, supervised survey design, interpreted data, critically revised the manuscript, and coordinated the overall study. All authors read and approved the final manuscript.

References

[1] WHO Classification of Tumours Editorial Board. (2021). Thoracic tumours (5th ed.). International Agency for Research on Cancer. Published online 2021.

[2] Popat S, Baas P, Faivre-Finn C, et al. Malignant pleural mesothelioma: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up . Annals of Oncology. 2022;33(2):129-142. https://doi.org/10.1016/j.annonc.2021.11.005

[3] Peters S, Scherpereel A, Cornelissen R, et al. First-line nivolumab plus ipilimumab versus chemotherapy in patients with unresectable malignant pleural mesothelioma: 3-year outcomes from CheckMate 743. Annals of Oncology. 2022;33(5):488-499. https://doi.org/10.1016/j.annonc.2022.01.074

[4] Calabrò L, Bronte G, Grosso F, et al. Immunotherapy of mesothelioma: the evolving change of a long-standing therapeutic dream. Front Immunol. 2023;14. https://doi.org/10.3389/fimmu.2023.1333661

[5] Pezzuto F, Lunardi F, Vedovelli L, et al. P14/ARF-Positive Malignant Pleural Mesothelioma: A Phenotype With Distinct Immune Microenvironment. Front Oncol. 2021;11. https://doi.org/10.3389/fonc.2021.653497

[6] Mannarino L, Paracchini L, Pezzuto F, et al. Epithelioid Pleural Mesothelioma Is Characterized by Tertiary Lymphoid Structures in Long Survivors: Results from the MATCH Study. Int J Mol Sci. 2022;23(10):5786. https://doi.org/10.3390/ijms23105786

[7] Fortarezza F, Pezzuto F, Maniglio S, et al. Adverse Prognostic Impact of Transitional and Pleomorphic Patterns in Pleural Nonepithelioid Mesothelioma Insights From Comprehensive Analysis and Reticulin Stain. https://doi.org/10.5858/arpa.2023-0523

[8] Rossi G, Righi L, Barbisan F, et al. BAP1 Loss, Nuclear Grading, and Nonepithelioid Features in the Diagnosis of Mesothelioma in Italy: Nevermore without the Pathology Report. J Pers Med. 2024;14(4):394. https://doi.org/10.3390/jpm14040394

[9] Husain AN, Chapel DB, Attanoos R, et al. Guidelines for Pathologic Diagnosis of Mesothelioma. Arch Pathol Lab Med. Published online November 1, 2024. https://doi.org/10.5858/arpa.2023-0304-ra

[10] Cigognetti M, Lonardi S, Fisogni S, et al. BAP1 (BRCA1-associated protein 1) is a highly specific marker for differentiating mesothelioma from reactive mesothelial proliferations. Modern Pathology. 2015;28(8):1043-1057. https://doi.org/10.1038/modpathol.2015.65

[11] Righi L, Duregon E, Vatrano S, et al. BRCA1-Associated Protein 1 (BAP1) Immunohistochemical Expression as a Diagnostic Tool in Malignant Pleural Mesothelioma Classification: A Large Retrospective Study. Journal of Thoracic Oncology. 2016;11(11):2006-2017. https://doi.org/10.1016/j.jtho.2016.06.020

[12] Pleural Specimens Tumour Size (Note 5) Mm maximum thickness of any mass Indeterminate dimensions of dominant mass Peritoneal Specimens dimensions of dominant mass dimensions of largest nodule and or Low Grade (Nuclear Grades I and II without Necrosis) High Grade (Nuclear Grade II with Necrosis, Nuclear Grade III with or without Necrosis).; 2022.

[13] Shiffman RN, Shekelle P, Overhage J Marc, et al. Standardized Reporting of Clinical Practice Guidelines: A Proposal from the Conference on Guideline Standardization*. Vol 139.; 2003. www.annals.org

[14] Swillens JEM, Sluijter CE, Overbeek LIH, et al. Identification of barriers and facilitators in nationwide implementation of standardized structured reporting in pathology: a mixed method study. Virchows Archiv. 2019;475(5):551-561. https://doi.org/10.1007/s00428-019-02609-6

[15] Febres-Aldana CA, Chang JC, Jungbluth AA, et al. Comparison of Immunohistochemistry, Next-generation Sequencing and Fluorescence In Situ Hybridization for Detection of MTAP Loss in Pleural Mesothelioma. Modern Pathology. 2024;37(3). https://doi.org/10.1016/j.modpat.2023.100420

[16] Chapel DB, Schulte JJ, Berg K, et al. MTAP immunohistochemistry is an accurate and reproducible surrogate for CDKN2A fluorescence in situ hybridization in diagnosis of malignant pleural mesothelioma. Modern Pathology. 2020;33(2):245-254. https://doi.org/10.1038/s41379-019-0310-0

[17] Chung CTS, Santos GDC, Hwang DM, et al. FISH assay development for the detection of p16/CDKN2A deletion in malignant pleural mesothelioma. J Clin Pathol. 2010;63(7):630-634. https://doi.org/10.1136/jcp.2010.076794

[18] Annaratone L, De Palma G, Bonizzi G, et al. Basic principles of biobanking: from biological samples to precision medicine for patients. Virchows Archiv. 2021;479(2):233-246. https://doi.org/10.1007/s00428-021-03151-0