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Malignant Pleural Mesothelioma: Epidemiological, Diagnostic, and Therapeutic Aspects at the National Oncology Institute in Rabat: A Retrospective Descriptive Study

H Lemsyeh, A Dahbi, K Taleb, M Hachlaf, C Abdi, W Nadir, Elghissassi, H Errihani

***Abstract*— Background: Malignant pleural mesothelioma (MPM) is a rare and aggressive cancer that develops from the mesothelial cells lining the pleural cavity, often linked to exposure to asbestos fibers. Despite recent progress in medical treatment, MPM continues to present difficulties in both diagnosis and treatment, with a grim outlook and few available therapies. Here, we outline the profiles and management of patients in daily practice at national oncology institute in Rabat.**

Methods: Retrospective observational study. Information was gathered from medical records. All individuals with histologically confirmed MPM identified between 2011 and 2022 were included.

Results: A total of nine cases of MPM were registered and treated between 2011 and 2022: mean age 54.4 years, male predominance 100%, exposure to asbestos 33%, epithelioïd type 89 %. radical surgery was not conducted in any case (0%). Chemotherapy was administered to 89 % of patients. First line regimens consisted mainly of platinum + Adriamycin (37%) or platinum + Gemcitabine (50 %) or Vinorelbine alone (13%). No response to treatment was observed in any cases, however 30% of patients experienced disease stabilization. 22% of these patients underwent second line chemotherapy (pemetrexed alone), Side effects were universally experienced, with 100% of patients developing anemia. Neutropenia was observed in 33% of patients, pancytopenia in 16%, vomiting in 50%, neuropathy in 16%, and alopecia in 16%.

Conclusion: according to our study, malignant pleural mesothelioma is considered a rare tumor and is often diagnosed late, which makes the prognosis very poor. Management can only be improved by early diagnosis and multidisciplinary consultation meetings.

***Index Terms*— asbestos, chemotherapy, mesothelioma, pleura.**

I. INTRODUCTION

Malignant pleural mesothelioma (MPM) is a rare and aggressive malignancy derived from the mesothelial cells that line the pleural cavity, mostly caused by asbestos fiber exposure. The incidence of MPM varies worldwide, with higher rates being reported in regions that have substantial asbestos usage, such as industrialized nations. There is usually a significant delay between exposure to asbestos and the development of MPM, ranging from 20 to 40 years [1].

Diagnosing MPM requires a combination of clinical assessment, imaging techniques including chest X-ray, CT scan, and MRI, and histopathological analysis of tissue. Immunohistochemical staining may be used throughout the diagnostic procedure to distinguish between malignant pleural mesothelioma and other types of cancer or non-cancerous diseases. Biomarkers such as soluble mesothelin-related peptide (SMRP) have been studied for their possible relevance in MPM diagnosis and prognosis [2].

Multimodal techniques including surgery, chemotherapy, and radiation therapy are among the treatment options for MPM, surgical therapies may include pleurectomy/decortication (P/D) or extra pleural pneumonectomy (EPP), depending on the severity of the disease and the patients.

Pemetrexed and cisplatin or carboplatin combinations are standard chemotherapy regimens for MPM. Radiation therapy can be used as part of multimodal therapy or as a palliative treatment to relieve symptoms and enhance quality of life [3].

Emerging therapeutic methods like immunotherapy and targeted therapy show promise for improving outcomes in MPM, but more study is needed to optimize their use [3].

A multidisciplinary approach is necessary for the management of MPM, encompassing the expertise of oncologists, thoracic surgeons, radiologists, and other specialists. This approach ensures that treatment strategies are individualized for each patient, taking into account various factors including disease stage, performance status, and comorbidities.

This retrospective descriptive study aims to analyze the epidemiological, diagnostic, and therapeutic features of MPM at the national oncology institute in rabat during a 12-year period. We aim to improve patient outcomes by studying the distinctive experiences and difficulties encountered in our region to expand understanding of MPM management.

II. MATERIALS AND METHODS:

We conducted a retrospective study at the National Institute of Oncology, Rabat, meticulously reviewing the

Hajar Lemsyeh, Department of medical oncology, The national institute of oncology of Rabat, Morocco
Khaoula Taleb, Department of medical oncology, The national institute of oncology of Rabat, Morocco
Ayoub Dahbi medical generalist, IBN SINA University Hospital in Rabat.
Mariem Hachlaf , Department of medical oncology, The national institute of oncology of Rabat, Morocco
Chaimae Abdi, National institute of oncology, Rabat, Morocco
Nadir Wydad, National institute of oncology, Rabat, Morocco
Ibrahim Elghissassi,Professor of the Department of Medical Oncology, the National Institute of Oncology, Rabat,Morocco.
Hassan Errihani: Professor of the Department of Medical Oncology, National Institute of Oncology, Rabat, Morocco.

medical records of patients diagnosed and treated for Malignant Pleural Mesothelioma. We studied all cases treated at our institution, specifically those with histologically confirmed MPM identified from 2011 to 2022. To be eligible for the study, patients needed a confirmed diagnosis within the specified timeframe, excluding individuals undergoing treatment for recurrent mesothelioma diagnosed prior to 2011. Data was collected on patient asbestos exposure, symptoms, diagnostic methods, and treatment regimens from electronic records "ENOVA Sante" in the medical oncology department of the Institute of Oncology, as well as paper files in the archive service. The data was entered into a computer system and analyzed using Microsoft Office Excel for descriptive data analysis.

III. RESULTS:

We included nine patients diagnosed and managed at national institute of oncology, Rabat. Their main characteristics are summarized in Table I.

Table I Main characteristics of patients (n = 9)

Age at diagnosis, years 5 (mean)	54.4
Gender, male (n=9)	9 (100%)
Symptomatic at diagnosis (n = 9),	9(100%)
Dyspnea	5(56%)
Thoracic pain	6(67%)
Cough	2(22%)
Weight loss	1(11%)
Exposure to asbestos (n =9), n (%)	3(33%)
performance status	
PS 0	1(11%)
PS 1	7(78%)
PS 2	1(11%)

Men accounted for 100 % of the study. A majority of patients had respiratory symptoms at diagnosis, mainly dyspnea (56%) and thoracic pain (67%). A previous exposure to asbestos was identified in 33 % of cases.

Table II: examination performed for disease staging

Thoracic CT	9(100%)
Pleural thickening	
Diffuse	8(89%)
Nodular	1(11%)
Pleural effusion	4(44%)
Calcifications	1(11%)
Lymphadenopathy	2(22%)
Abdomino-pelvic CT	6(67%)
Bone scan	3(33%)
Cerebral CT	2(22%)

Examinations performed for disease staging included thoracic CT scan (100 %), abdomino-pelvic CT scan (67 %), bone scan (33%) and cerebral CT (22%) Table 2. The epithelioïd type was the most frequent (89 %) followed by desmoplastic (11%), any case for sarcomatoide or biphasic types. Table II.

In our series, given the unresectability of the tumor, no patient benefited from curative surgery. In addition, pleurodesis was performed in only one patient (11%). Radiotherapy to the biopsy site was initiated in 2 patients with a dose of 21 Gy over 3 sessions. First-line chemotherapy was administered to 8 (89%) patients, among whom 2 had second line chemotherapy. Most frequently used chemotherapy regimens were Gemcitabine + Cisplatin (50%) in first line, and pemetrexed as single agent in 2nd line.

The treatment did not produce a response in any of the cases. However, disease stabilization was noted in three patients (33%). One patient showed progression with the development of multiple intraparenchymal pulmonary nodules (11%). The rest of the patients were either being assessed or could not be reached for further monitoring. All patients experienced side effects, including anemia in every case. Neutropenia was detected in 33% of patients, pancytopenia in 11%, vomiting in 50%, neuropathy in 16%, and alopecia in 16%.

IV. DISCUSSION

MPM is a relatively rare disease, with an estimated incidence of 2 cases per million inhabitants per year, which can vary depending on the country [4]. While it is not a common condition, it is primarily linked to asbestos exposure. A significant majority of individuals diagnosed with MPM have, at some stage, experienced exposure to asbestos fibers, whether directly or indirectly [5]. It is strictly prohibited in the United States, Europe, Australia, and other countries [6]. Despite the ban, there has been no significant decrease in MPM cases, as new instances continue to emerge due to the disease's late onset [7]. However, in certain industrialized countries, like China, the production and use of asbestos are still not tightly regulated. This lack of control is expected to contribute to a continued rise in the incidence of MPM in the coming decades [8],[9].
In our work, over 12 years, a total of 9 cases of malignant pleural mesothelioma (MPM) were documented, indicating an annual occurrence rate of 0.75 cases. This highlights the rarity of these tumors, a fact that is also supported by existing literature.

There was a significant difference observed between the two sexes, with a much higher incidence of mesothelioma in males [10]. This is likely due to the fact that males make up the majority of the workforce in industries such as mining, shipbuilding, and construction [11].

In our study, 100% of affected patients were men.

MPM takes a considerable amount of time to develop after asbestos exposure. The period of time between exposure and diagnosis of MPM can often span several decades. Recent studies have demonstrated that the risk of developing the condition increases steadily for up to 45 years after exposure [12]. This helps to explain why the majority of individuals affected by the condition are typically over the age of 60, with the highest incidence occurring between 80 and 84 years for men and between 75 and 79 years for women[13],[14].MPM can also impact children and young adults, although there is a lack of available data regarding the prevalence of this

disease among this age group. According to data from an autopsy series, the rate of pediatric mesothelioma was estimated to be between 2 and 5% of all mesothelioma cases. This represents a very low occurrence, with only 0.5 to 1 case per 10 million people per year [15]. There have been limited publications on pediatric MPMs and cases in young adults in the literature. The available reports and articles are few in number and some are quite old [16]-[21]. For our study, the average age at diagnosis was 54 years, with extremes ranging from 25 to 75 years.

Exposure to asbestos fibers plays a crucial role in the development of Malignant Pleural Mesothelioma (MPM) [14]. In approximately 80% of those diagnosed with malignant mesothelioma (MM), a prior asbestos exposure has been documented [22].

Ionizing radiation has been recognized as a contributing factor in the development of MPM [23]. Furthermore, there is compelling evidence that suggests a connection between MPM and the Simian virus 40 (SV40) [24]. Many patients diagnosed with mesothelioma have exhibited antibodies against SV40, providing further support for this association [25]. Genetic factors, such as the decreased expression of the BAP1 gene or the BRCA1-associated protein, also play a role in the risk of developing MPM [26]. Genetic changes, particularly when combined with asbestos exposure, increase the likelihood of developing pleural mesotheliomas. In addition, the presence of mesothelioma in families indicates a potential genetic susceptibility [27].

Concerning the etiopathogenic factors identified in our research, asbestos exposure was reported in 33% of cases, and neither irradiation nor familial mesothelioma cases were present; this limitation may be attributed to the small sample size.

The clinical manifestations observed in our research align with those documented in the literature. These manifestations lack specificity and manifest towards the latter stages of the neoplasia's progression. The symptoms most commonly reported in the literature are dyspnea and chest pain (90 %), which are both associated with pleural effusion. Other symptoms, including sweating and shivers (22 %), asthenia (36%), cough (22%), and sweating, occur infrequently [28].

CT imaging plays a crucial role in patients with MPM. CT findings associated with pleural malignancy may include pleural enhancement, infiltration of the chest wall, mediastinum or diaphragm, nodular or mediastinal pleural thickening, and interlobar fissural nodularity [29]. Certain studies have indicated a considerable level of sensitivity and specificity linked to these characteristics. Nevertheless, it's important to note that interpretations can vary and heavily operator dependent. A study on the diagnostic accuracy of CT scans found that the sensitivity and specificity for detecting pleural malignancy were reported to be 68% and 78%, respectively [30]. CT cannot reliably distinguish between MPM and metastatic pleural malignancy, although there are more cases of circumferential pleural thickening and mediastinal pleural involvement in MPM [31]. it is important to note that CT scans may not always be able to accurately differentiate between different subtypes of MPM. However, certain features such as ipsilateral volume loss, interlobar fissural involvement, and mediastinal pleural involvement are more commonly observed in sarcomatoid disease [32]. CT staging is valuable in MPM, as advanced stage disease is linked to poorer prognoses [33]. However, precise staging can pose a challenge as nodal metastases can be hard to identify on CT scans and subtle invasion of the chest wall or diaphragm may go unnoticed [34]. Additional information can be obtained through further imaging using positron-emission technology (PET)-CT or magnetic resonance imaging (MRI).

In our study, chest computed tomography revealed pleural thickening in 88% of cases and mediastinal lymphadenopathy in 22% of cases.

There are three histological variants of MPM from a histopathological perspective [35]: The epithelioid subtype is the most common form, accounting for 50 to 70% of cases. This particular form has a more positive prognosis compared to the other two types. It responds well to chemotherapy, which is why patients with this tumor tend to have longer survival rates. The median survival can reach up to 11 months. The biphasic subtype is a variant that makes up about 25-30% of MPMs. Its prognosis is not as favorable as the epithelioid subtype, with a median survival of around 7 months. The final subtype is the sarcomatoid, which makes up 10-20% of MPM cases and is known for being the most aggressive form. The prognosis for this condition is not very optimistic, with a median survival of only 3 months [36].

In our study, the epithelioid form was found in 89% of cases and one single case with sarcomatoide form.

There are a variety of treatment options available, such as surgery, radiotherapy, and systemic treatment. The decision regarding the therapeutic choice should be made collaboratively during a multidisciplinary consultation meeting. Considering the delay in diagnosis, it appears that opting for systemic treatment would be the most logical approach to potentially enhance the survival rate of patients with MPM [37]. Different combinations of chemotherapy are used. Vogelzang et al. revealed In the EMPHACIS study published in 2003 that a combination of CISPLATINE (75mg/m2/3W) and PEMETREXED (500mg/m2/3W) can help to enhance overall survival, progression-free survival, and response rate compared to a single-agent for patients with locally advanced unresectable or metastatic MPM [38] .In the MAPS study, triple therapy (standard pemetrexed/cisplatin + bevacizumab) demonstrated enhanced overall survival and progression-free survival [39],it is regarded as a viable option for treatment, despite not being officially endorsed as the primary choice.

Another study demonstrated that the overall survival of patients was enhanced when they received combination therapy with raltitrexed/cisplatin, as opposed to treatment with cisplatin alone [40].

Immunotherapy has been explored as a potential treatment for MPM. This includes the use of immune checkpoint inhibitors like anti-CTLA-4 monoclonal antibodies or monoclonal antibodies that target PD-1 or PD-L1. These

inhibitors have been tested in MPM, both as standalone treatments and in combination with chemotherapy [41]. The clinical response observed was not as significant as in other solid malignant tumors. In the CHECKMATE 743 trial, the NIVOLUMAB-IPILIMUMAB combination demonstrated superior effectiveness when compared to chemotherapy. The trial showed a notable increase in overall survival (OS) for patients who underwent treatment with nivolumab plus ipilimumab, in comparison to those who received chemotherapy. The median overall survival was 18.1 months (95% CI: 16.8, 21.5) compared to 14.1 months (95% CI: 12.5, 16.2) with a hazard ratio of 0.74 (95% CI: 0.61, 0.89; p=0.002).

In our study, 87% of our patients received a regimen based on platinum salts, with GEMCITABINE or DOXORUBICIN at place of PEMETREXED by breaking the latter. And 13% received VINORELBINE alone.

Using radiation therapy as a treatment for MPM can be done either as a neoadjuvant before PEP with a dose of 5-6 Gy [42], or as an adjuvant with a dose of 50-60Gy [43]. However, it is primarily utilized in a palliative context [44].

In our serie Radiotherapy to the biopsy site was initiated in 2 patients with a dose of 21 Gy over 3 sessions.

V. CONCLUSION

According to the findings of this study, it is evident that MPM is an exceptionally uncommon tumor with a bleak prognosis, typically leading to a fatal outcome. Studying the prognostic factors that influence survival was challenging due to the limited number of patients included in the study and the absence of patient medical records. It would be valuable to conduct a comprehensive study to better understand the factors that impact survival in patients with MPM. This study could provide statistically significant evidence and enable the implementation of clinical trials with well-matched patient groups. By doing so, we can recommend appropriate treatments that have the potential to enhance prognosis.

REFERENCES

[1]. Bianchi C, Bianchi T. Malignant mesothelioma: global incidence and relationship with asbestos. Ind Health. 2007;45(3):379-387. doi:10.2486/indhealth.45.379

[2]. Cui A, Jin XG, Zhai K, Tong ZH, Shi HZ. Diagnostic values of soluble mesothelin-related peptides for malignant pleural mesothelioma: updated meta-analysis. BMJ Open. 2014;4(2):e004145. doi:10.1136/bmjopen-2013-004145

[3]. Bibby AC, Tsim S, Kanellakis N, et al. Malignant pleural mesothelioma: an update on investigation, diagnosis and treatment. Eur Respir Rev Off J Eur Respir Soc. 2016;25(142):472-486. doi:10.1183/16000617.0063-2016

[4]. Sculier JP, Vansteenkiste J, Schönfeld N, Scherpereel A. Thoracic oncology in Europe: the ERS action plan by the Thoracic Oncology Assembly. Eur Respir J. 2010;36(6):1227-1228. doi:10.1183/09031936.00146810

[5]. Asbestos, asbestosis, and cancer: the Helsinki criteria for diagnosis and attribution. Scand J Work Environ Health. 1997;23(4):311-316.

[6]. Baumann F, Ambrosi JP, Carbone M. Asbestos is not just asbestos: an unrecognised health hazard. Lancet Oncol. 2013;14(7):576-578. doi:10.1016/S1470-2045(13)70257-2

[7]. Alpert N, van Gerwen M, Taioli E. Epidemiology of mesothelioma in the 21st century in Europe and the United States, 40 years after restricted/banned asbestos use. Transl Lung Cancer Res. 2020;9(Suppl 1):S28-S38. doi:10.21037/tlcr.2019.11.11

[8]. Guo Z, Carbone M, Zhang X, et al. Improving the accuracy of mesothelioma diagnosis in China. J Thorac Oncol Off Publ Int Assoc Study Lung Cancer. 2017;12(4):714-723. doi:10.1016/j.jtho.2016.12.006

[9]. Leong SL, Zainudin R, Kazan-Allen L, Robinson BW. Asbestos in Asia. Respirol Carlton Vic. 2015;20(4):548-555. doi:10.1111/resp.12517

[10]. Panou V, Weinreich U, Bak J, et al. Gender differences in asbestos exposure and disease location in 327 patients with mesothelioma. In: ; 2017:PA4294. doi:10.1183/1393003.congress-2017.PA4294

[11]. Zhai Z, Ruan J, Zheng Y, et al. Assessment of Global Trends in the Diagnosis of Mesothelioma From 1990 to 2017. JAMA Netw Open. 2021;4(8):e2120360. doi:10.1001/jamanetworkopen.2021.20360

[12]. Reid A, de Klerk NH, Magnani C, et al. Mesothelioma risk after 40 years since first exposure to asbestos: a pooled analysis. Thorax. 2014;69(9):843-850. doi:10.1136/thoraxjnl-2013-204161

[13]. Robinson BM. Malignant pleural mesothelioma: an epidemiological perspective. Ann Cardiothorac Surg. 2012;1(4):491-496. doi:10.3978/j.issn.2225-319X.2012.11.04

[14]. Wagner JC, Sleggs CA, Marchand P. Diffuse pleural mesothelioma and asbestos exposure in the North Western Cape Province. Br J Ind Med. 1960;17(4):260-271. doi:10.1136/oem.17.4.260

[15]. Kashanskiy SV, André N. [Paediatric mésothelioma: is there the such a disease?]. Bull Cancer (Paris). 2010;97(5):571-576. doi:10.1684/bdc.2010.1064

[16]. Rosas-Salazar C, Gunawardena SW, Spahr JE. Malignant pleural mesothelioma in a child with ataxia-telangiectasia. Pediatr Pulmonol. 2013;48(1):94-97. doi:10.1002/ppul.22535

[17]. Sugalski A, Davis M, Prasannan L, Saldivar V, Hung JY, Tomlinson GE. Clinical, histologic, and genetic features of mesothelioma in a 7-year-old child. Pediatr Blood Cancer. 2013;60(1):146-148. doi:10.1002/pbc.24284

[18]. Gong YS, Rong YT, Han WC, Zhang YC. Peripheral lymphadenopathy as the initial manifestation of malignant mesothelioma in a child. Hum Pathol. 2013;44(4):664-669. doi:10.1016/j.humpath.2012.09.011

[19]. Grundy GW, Miller RW. Malignant mesothelioma in childhood. Report of 13 cases. Cancer. 1972;30(5):1216-1218. doi:10.1002/1097-0142(197211)30:5<1216::aid-cncr2820300511>3.0.co;2-5

[20]. Fraire AE, Cooper S, Greenberg SD, Buffler P, Langston C. Mesothelioma of childhood. Cancer. 1988;62(4):838-847. doi:10.1002/1097-0142(19880815)62:4<838::aid-cncr2820620433>3.0.co;2-9

[21]. Voulgaridis A, Apollonatou V, Lykouras D, et al. Pleural mesothelioma in a young male patient. Monaldi Arch Chest Dis Arch Monaldi Mal Torace. 2013;79(2):96-99. doi:10.4081/monaldi.2013.100

[22]. Robinson BWS, Lake RA. Advances in malignant mesothelioma. N Engl J Med. 2005;353(15):1591-1603. doi:10.1056/NEJMra050152

[23]. Goodman JE, Nascarella MA, Valberg PA. Ionizing radiation: a risk factor for mesothelioma. Cancer Causes Control CCC. 2009;20(8):1237-1254. doi:10.1007/s10552-009-9357-4

[24]. Gazdar AF, Carbone M. Molecular pathogenesis of malignant mesothelioma and its relationship to simian virus 40. Clin Lung Cancer. 2003;5(3):177-181. doi:10.3816/CLC.2003.n.031

[25]. Burmeister B, Schwerdtle T, Poser I, et al. Effects of asbestos on initiation of DNA damage, induction of DNA-strand breaks, P53-expression and apoptosis in primary, SV40-transformed and malignant human mesothelial cells. Mutat Res. 2004;558(1-2):81-92. doi:10.1016/j.mrgentox.2003.11.003

[26]. Panou V, Gadiraju M, Wolin A, et al. Frequency of Germline Mutations in Cancer Susceptibility Genes in Malignant Mesothelioma. J Clin Oncol Off J Am Soc Clin Oncol. 2018;36(28):2863-2871. doi:10.1200/JCO.2018.78.5204

[27]. Ohar JA, Cheung M, Talarchek J, et al. Germline BAP1 Mutational Landscape of Asbestos-Exposed Malignant Mesothelioma Patients with Family History of Cancer. Cancer Res. 2016;76(2):206-215. doi:10.1158/0008-5472.CAN-15-0295

[28]. Muers MF, Stephens RJ, Fisher P, et al. Active symptom control with or without chemotherapy in the treatment of patients with malignant pleural mesothelioma (MS01): a multicentre randomised trial. Lancet Lond Engl. 2008;371(9625):1685-1694. doi:10.1016/S0140-6736(08)60727-8

[29]. Hierholzer J, Luo L, Bittner RC, et al. MRI and CT in the differential diagnosis of pleural disease. Chest. 2000;118(3):604-609. doi:10.1378/chest.118.3.604

[30]. Rahman NM, Pepperell J, Rehal S, et al. Effect of Opioids vs NSAIDs and Larger vs Smaller Chest Tube Size on Pain Control and Pleurodesis Efficacy Among Patients With Malignant Pleural Effusion: The TIME1 Randomized Clinical Trial. JAMA. 2015;314(24):2641-2653. doi:10.1001/jama.2015.16840
[31]. Metintas M, Ucgun I, Elbek O, et al. Computed tomography features in malignant pleural mesothelioma and other commonly seen pleural diseases. Eur J Radiol. 2002;41(1):1-9. doi:10.1016/s0720-048x(01)00426-0
[32]. Seely JM, Nguyen ET, Churg AM, Müller NL. Malignant pleural mesothelioma: computed tomography and correlation with histology. Eur J Radiol. 2009;70(3):485-491. doi:10.1016/j.ejrad.2008.02.004
[33]. Rusch VW, Giroux D, Kennedy C, et al. Initial analysis of the international association for the study of lung cancer mesothelioma database. J Thorac Oncol Off Publ Int Assoc Study Lung Cancer. 2012;7(11):1631-1639. doi:10.1097/JTO.0b013e31826915f1
[34]. Heelan RT, Rusch VW, Begg CB, Panicek DM, Caravelli JF, Eisen C. Staging of malignant pleural mesothelioma: comparison of CT and MR imaging. AJR Am J Roentgenol. 1999;172(4):1039-1047. doi:10.2214/ajr.172.4.10587144
[35]. Husain AN, Colby TV, Ordóñez NG, et al. Guidelines for Pathologic Diagnosis of Malignant Mesothelioma 2017 Update of the Consensus Statement From the International Mesothelioma Interest Group. Arch Pathol Lab Med. 2018;142(1):89-108. doi:10.5858/arpa.2017-0124-RA
[36]. Musk AW, Olsen N, Alfonso H, et al. Predicting survival in malignant mesothelioma. Eur Respir J. 2011;38(6):1420-1424. doi:10.1183/09031936.00000811
[37]. Tomek S, Manegold C. Chemotherapy for malignant pleural mesothelioma: past results and recent developments. Lung Cancer Amst Neth. 2004;45 Suppl 1:S103-119. doi:10.1016/j.lungcan.2004.04.020
[38]. Krug LM, Pass HI, Rusch VW, et al. Multicenter phase II trial of neoadjuvant pemetrexed plus cisplatin followed by extrapleural pneumonectomy and radiation for malignant pleural mesothelioma. J Clin Oncol Off J Am Soc Clin Oncol. 2009;27(18):3007-3013. doi:10.1200/JCO.2008.20.3943
[39]. Zalcman G, Mazieres J, Margery J, et al. Bevacizumab for newly diagnosed pleural mesothelioma in the Mesothelioma Avastin Cisplatin Pemetrexed Study (MAPS): a randomised, controlled, open-label, phase 3 trial. Lancet Lond Engl. 2016;387(10026):1405-1414. doi:10.1016/S0140-6736(15)01238-6
[40]. van Meerbeeck JP, Gaafar R, Manegold C, et al. Randomized phase III study of cisplatin with or without raltitrexed in patients with malignant pleural mesothelioma: an intergroup study of the European Organisation for Research and Treatment of Cancer Lung Cancer Group and the National Cancer Institute of Canada. J Clin Oncol Off J Am Soc Clin Oncol. 2005;23(28):6881-6889. doi:10.1200/JCO.20005.14.589
[41]. Wu L, de Perrot M. Radio-immunotherapy and chemo-immunotherapy as a novel treatment paradigm in malignant pleural mesothelioma. Transl Lung Cancer Res. 2017;6(3):325-334. doi:10.21037/tlcr.2017.06.03
[42]. Cho BCJ, Feld R, Leighl N, et al. A feasibility study evaluating Surgery for Mesothelioma After Radiation Therapy: the "SMART" approach for resectable malignant pleural mesothelioma. J Thorac Oncol Off Publ Int Assoc Study Lung Cancer. 2014;9(3):397-402. doi:10.1097/JTO.0000000000000078
[43]. Rusch VW, Rosenzweig K, Venkatraman E, et al. A phase II trial of surgical resection and adjuvant high-dose hemithoracic radiation for malignant pleural mesothelioma. J Thorac Cardiovasc Surg. 2001;122(4):788-795. doi:10.1067/mtc.2001.116560
[44]. Baas P, Fennell D, Kerr KM, et al. Malignant pleural mesothelioma: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. Ann Oncol Off J Eur Soc Med Oncol. 2015;26 Suppl 5:v31-39. doi:10.1093/annonc/mdv199

AUTHORS PROFILE

Hajar Lemsyeh, Department of medical oncology, The national institute of oncology of Rabat, Morocco.
Khaoula Taleb, Department of medical oncology, The national institute of oncology of Rabat, Morocco Ayoub Dahbi medical generalist, IBN SINA University Hospital in Rabat.
Mariem Hachlaf , Department of medical oncology, The national institute of oncology of Rabat, Morocco.
Chaimae Abdi, National institute of oncology, Rabat, Morocco
Nadir Wydad, National institute of oncology, Rabat, Morocco
Ibrahim Elghissassi,Professor of the Department of Medical Oncology, the National Institute of Oncology, Rabat,Morocco.
Hassan Errihani: Professor of the Department of Medical Oncology, National Institute of Oncology, Rabat, Morocco.