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Pleurectomy–decortication in malignant pleural mesothelioma: are different surgical techniques associated with different outcomes? Results from a multicentre study†

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Abstract

OBJECTIVES: The potential benefit of surgery for malignant pleural mesothelioma (MPM), especially concerning pleurectomy/decortication (P/D), is unclear from the literature. The aim of this study was to evaluate the outcome after multimodality treatment of MPM involving different types of P/D and to analyse the prognostic factors.

METHODS: We reviewed 314 patients affected by MPM who were operated on in 11 Italian centres from 1 January 2007 to 11 October 2014.

RESULTS: The characteristics of the population were male/female ratio: 3.7/1, and median age at operation was 67.8 years. The epithelioid histotype was observed in 79.9% of patients; neoadjuvant chemotherapy was given to 57% of patients and Stage III disease was found following a pathological analysis in 62.3% of cases. A total of 162 (51.6%) patients underwent extended P/D (EP/D); 115 (36.6%) patients had P/D and 37 (11.8%) received only a partial pleurectomy. Adjuvant radiotherapy was delivered in 39.2% of patients. Median overall survival time after surgery was 23.0 [95% confidence interval (CI): 19.6–29.1] months. On multivariable (Cox) analysis, pathological Stage III–IV [$P = 0.004$, hazard ratio (HR):1.34; 95% CI: 1.09–1.64], EP/D and P/D ($P = 0.006$, HR for EP/D: 0.46; 95% CI: 0.29–0.74; HR for P/D: 0.52; 95% CI: 0.31–0.87), left-sided disease ($P = 0.01$, HR: 1.52; 95% CI: 1.09–2.12) and pathological status T4 ($P = 0.0003$, HR: 1.38; 95% CI: 1.14–1.66) were found to be independent significant predictors of overall survival.

CONCLUSIONS: Whether the P/D is extended or not, it shows similarly good outcomes in terms of early results and survival rate. In contrast, a partial pleurectomy, which leaves gross tumour behind, has no impact on survival.

Keywords: Malignant pleural mesothelioma • Pleurectomy–decortication • Prognostic factors

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INTRODUCTION

Malignant pleural mesothelioma (MPM) is an aggressive tumour with poor prognosis even when treated. Therefore, finding an effective treatment has been a challenge for the last 30 years [1].

The available, albeit limited, data on the treatment of patients with MPM suggest that multimodality therapy leads to better results compared with other strategies. Surgical treatment options for MPM include extrapleural pneumonectomy (EPP) and pleurectomy/decortication (P/D), both of which can be incorporated into multimodality regimens involving neoadjuvant or adjuvant chemotherapy and adjuvant radiotherapy [2].

Because of the diffuse growth pattern and the lack of surgical margins, microscopic complete resection is theoretically impossible. Thus, a macroscopic complete resection (MCR) is the most one can expect to achieve with surgical resection, even though the optimal cytoreductive procedure is still controversial [3, 4]. EPP is a well-codified operation, and for many years, it was considered the best surgical option to achieve MCR and to obtain a survival advantage [3]. The definition of P/D, on the other hand, has varied according to the surgical technique, therapeutic intent and clinical indications [5, 6].

P/D was initially proposed as a valid cytoreductive surgical alternative to EPP for patients who were unwilling to undergo EPP or who did meet the indications for EPP [7–9]. Recently, 2 meta-analyses comparing the 2 surgical procedures suggested significantly lower perioperative mortality and morbidity rates and a trend towards longer survival for patients who had P/D in comparison with EPP [10, 11].

In 2011, the consensus report by the International Mesothelioma Interest Group and the International Association for the Study of Lung Cancer (IASLC) recommended that the surgical procedures be classified into 3 well-defined categories: (i) EP/D, (ii) P/D and (iii) partial pleurectomy [12]. The potential benefits of surgery are still unclear from the literature, especially concerning P/D, and few authors have evaluated the clinical impact and outcome of patients who have had different types of P/D. The aim of the study was to evaluate the outcome after multimodality treatment of MPM involving different types of P/D and to analyse the prognostic factors.

MATERIALS AND METHODS

Data from 314 patients affected by histologically proven MPM and operated on between 1 January 1 2007 and 11 October 2014 were prospectively collected from 11 Italian centres and reviewed.

Demographics and clinical preoperative, operative and postoperative data were considered for statistical analysis. Preoperative studies included total body computed tomography (CT) scans and/or positron emission tomography CT scans, electrocardiograms, echocardiograms and spirometry with blood gas analysis. Tumour, node and metastasis (TNM) and International Mesothelioma Interest Group staging systems were used to define the extent of the disease.

Patients underwent the multimodality approach based on a single-centre protocol comprising induction chemotherapy and/or adjuvant treatment with surgical resection.

All patients had a pleurectomy through a posterolateral thoracotomy. All centres reviewed the operative charts so they could define the surgical procedures according to the International Mesothelioma Interest Group/International Association for the Study of Lung Cancer classification [12] system, which provides 3 categories depending on the surgical technique: (i) extended P/D (EP/D): parietal and visceral pleurectomy to remove all gross tumour, with resection of the diaphragm and/or pericardium; (ii) P/D: parietal and visceral pleurectomy to remove all gross tumour, without resection of the diaphragm or pericardium; and (iii) partial pleurectomy: partial removal of parietal and/or visceral pleura for diagnostic or palliative purposes, leaving gross tumour behind.

The choice of EP/D versus P/D was determined by the macroscopic absence/presence of diaphragmatic and pericardial involvement by the disease: In both procedures, an MCR was the goal.

Operative complications were separated into major (acute respiratory distress syndrome, pneumonia, bronchopleural fistula, reintubation, placement of tracheostomy, pulmonary embolus, empyema, sepsis, myocardial infarction, ventricular arrhythmia requiring treatment, return to operating room, acute renal failure, chylothorax, deep venous thrombosis and others) and minor complications (atrial arrhythmia requiring treatment, anaemia, urinary tract infection, delirium, prolonged air leaks and others) for the purpose of analysis. Major complications were considered those that required a second surgical look or that were associated with the risk of death or a significantly prolonged hospital stay due to the need for intensive medical support.

For induction and/or adjuvant chemotherapy, a platinum-based regimen with gemcitabine or pemetrexed was used for 3 to 4 cycles. Adjuvant radiotherapy was not standardized and varied from radiation limited to the surgical scars or a boost to the macroscopic residual tumour (20–30 Gy) to standard radiation treatment, helical tomotherapy or intensity-modulated radiation therapy (dose range 40–50 Gy).

Patients were followed up with clinical checks, imaging studies (CT scan and/or positron emission tomography CT scan) and a phone interview every 4 months for the first year and then every 6 months for the following years. Survival was calculated from the date of surgery to the date of last follow-up or death. The following parameters were considered and evaluated in the statistical analysis: age, gender, side of the disease, histology, preoperative treatments, type of surgical intervention, postoperative treatments, T and N status and pathological stage.

Statistical analysis

In the statistical description, data are expressed as absolute numbers, percentages and mean or median values. The association between qualitative variables was verified by means of the χ^2 test or the Fisher test, as appropriate. The Kaplan–Meier method was used to model survival during follow-up to estimate the median survival time and the 95% confidence interval (CI) and to compare survival curves with the log-rank test. Simple Cox proportional hazard regression was used to calculate the unadjusted hazard ratio (HR) for prognostic factors. A forward stepwise Cox regression model, with entry and stay of variables showing a significance level of at least 0.1, was applied to obtain adjusted HRs. All statistical analyses were performed using SAS statistical software release 9.3 (SAS Institute, Cary, NC, USA) with the significance level set at $P < 0.05$.

RESULTS

Patients' characteristics as a whole population and divided by the type of surgical intervention are summarized in Table 1. One hundred sixty-two (51.6%) patients had EP/D; 115 (36.6%) patients underwent P/D; and 37(11.8%) received only a partial pleurectomy. Thirty- and 90-day mortality rates were 2.2% ($n = 7$) and 3.5% ($n = 11$), respectively. The 30-day mortality rates for EP/D, P/D and partial pleurectomy were not significantly different (2.5% vs 1.7% vs 2.7%, respectively; $P = 0.88$ by the Fisher's exact test); a similar result was observed regarding the 90-day mortality rates (3.1% vs 3.5% vs 5.4%, respectively; $P = 0.75$ by the Fisher's exact test). Causes of perioperative (30-day) death were massive pulmonary embolism ($n = 2$), bleeding ($n = 1$), myocardial infarction ($n = 1$), stroke ($n = 1$), ventricular arrhythmia ($n = 1$) and unknown ($n = 1$). The overall major morbidity rate was 15.9% ($n = 50$), with a significantly ($P < 0.001$) higher rate for EP/D (17.9%) and P/D (16.5%) compared with partial pleurectomy (5.4%); the type and distribution of major complications based on the different surgical approaches are reported in Table 2. A total of 139 minor complications (prolonged air leaks [$n = 51$], anaemia requiring transfusions or not [$n = 43$], atrial fibrillation [$n = 30$] and other [$n = 15$]) were observed in 115 (36.6%) patients.

After the operation, 123 (39.2%) patients were submitted to adjuvant radiotherapy with different treatment modalities (conventional radiotherapy, intensity-modulated radiation therapy and helical tomotherapy); 102 (32.5%) had radiotherapy limited to the surgical scars or to a boost to macroscopic residual disease and 89 (28.3%) did not receive any radiation treatment. A platinum-based adjuvant chemotherapeutic regime was administered to 75 (23.9%) patients.

At the end of the follow-up (median 15.5 months, range 1–118 months) period, 142 (45.2%) patients were alive; 157 (50%) had died; and 15(4.8%) were lost after a median time of initial clinical observation of 5 (range 1–13) months (Table 2).

The median overall survival after the operation was 23.0 (95% CI: 19.6–29.1) months, with 3-and 5-year survival rates of 37.5% and 21%, respectively (Fig. 1). The results of the statistical analysis of prognostic factors are reported in Table 3. On univariable analysis, the left-sided disease ($P = 0.02$), the partial pleurectomy intervention ($P = 0.003$), the pathological T4-stage ($P = 0.0002$), the positive nodal status ($P = 0.03$) and the pathological disease

Table 1: Patients' overall characteristics and by the type of intervention

Clinical Factor	All patients (*N* = 314) *n* (%)	EP/D (*N* = 162; 51.6%) *n* (%)	P/D (*N* = 115; 36.6%) *n* (%)	Partial pleurectomy (*N* = 37; 11.8%) *n* (%)	*P*-value[a]
Gender (female:male)	67:247 (21.3:78.7)	40:122 (24.7:75.3)	24:91 (20.9:79.1)	3:34 (8.1:91.8)	0.08
Age at surgery (years)					
Mean ± SD (range)	66.5 ± 8.5 (40.2–84.3)	66.3 ± 8.8 (40.2–84.3)	66.3 ± 8.2 (45.3–79.3)	68.4 ± 8.4 (48.3–82.1)	0.37[b]
Histology					
Epithelioid	251 (79.9)	130 (80.3)	92 (80.0)	29 (78.4)	na
Sarcomatoid	10 (3.2)	2 (1.2)	4 (3.5)	4 (10.8)	
Biphasic	51 (16.2)	29 (17.9)	18 (15.6)	4 (10.8)	
Desmoplastic	2 (0.6)	1 (0.6)	1 (0.9)	0 (0.0)	
Neoadjuvant chemotherapy	179 (57.0)	90 (55.6)	73 (63.5)	16 (43.2)	0.08
Side					0.51
Right	206 (65.5)	107 (65.8)	72 (62.6)	27 (73.0)	
Left	108 (34.5)	55 (34.2)	43 (37.4)	10 (27.0)	
pT stage	(7 Missing)				0.006
T0	6 (2.0)	3 (1.9)	3 (2.7)	0 (0.0)	
T1	40 (13.0)	19 (11.9)	17 (15.2)	4 (11.4)	
T2	86 (27.1)	37 (23.1)	43 (38.4)	6 (17.1)	
T3	138 (28.0)	84 (52.5)	39 (34.8)	15 (42.9)	
T4	37 (12.0)	17 (10.6)	10 (8.9)	10 (28.6)	
pN STAGE	(7 Missing)				0.44[c]
N0	236 (76.9)	117 (73.5)	88 (78.6)	31 (86.1)	
N1	13 (4.2)	9 (5.7)	4 (3.6)	0 (0.0)	
N2	57 (18.6)	33 (20.8)	19 (17.0)	5 (13.9)	
N3	1 (0.3)	0 (0.0)	1 (0.9)	0 (0.0)	
Pathological IMIG stage	(7 Missing)				0.01[d]
0	6 (2.0)	3 (1.9)	3 (2.7)	0 (0.0)	
I	36 (11.7)	16 (10.0)	17 (15.2)	3 (8.3)	
II	66 (21.4)	30 (18.8)	32 (28.6)	4 (11.1)	
III	192 (62.3)	104 (65.0)	59 (52.7)	29 (80.6)	
IV	8 (2.6)	7 (4.4)	1 (0.9)	0 (0.0)	
Adjuvant radiotherapy	123 (52.6)	60 (56.6)	54 (55.7)	9 (29.0)	0.02

na: not applicable; EP/D: extended pleurectomy/decortication; IMIG: International Mesothelioma Interest Group.
[a] χ^2 test.
[b] Parametric one-way analysis of variance.
[c] Fisher's exact test.
[d] Fisher's exact test using collapsed categories (0 + I; II; III + IV).

Table 2: Details of postoperative major complications and total survival and by type of intervention

	All patients (n = 314) *N*	Extended pleurectomy/ decortication (n = 162) *N*	Pleurectomy/ decortication (n = 115) *N*	Partial pleurectomy (n = 37) *N*	*P*-value [a]
Major complications					
Total	50	29	19	2	0.16
Haemothorax	8	4	4	0	0.68
Chylothorax	3	2	1	0	1.00
Emphysema	1	0	1	0	0.48
Diaphragmatic/cardiac patch failure	4	4	0	0	0.24
Pneumonia	4	3	1	0	0.78
Acute respiratory distress syndrome	8	4	4	0	0.68
Pulmonary embolism	5	3	2	0	0.99
Acute myocardial infarction	6	4	1	1	0.50
Stroke	4	1	3	0	0.44
Acute renal failure	2	1	1	0	1.00
Other	5	3	1	1	0.43
Follow-up length (months)					
Median (Q1–Q3)	15.5 (7.2–27.6)	18.1 (9.5–28.7)	13.1 (5.4–25.3)	10.2 (6.1–18.2)	0.0006[b]
Cumulative mortality *n* (%)	157 (50.0)	85 (52.5)	48 (41.7)	24 (64.9)	0.03[c]
Survival status at follow-up					
Alive without disease	85 (27.1)	48 (29.6)	35 (30.4)	0 (0)	0.01[c]
Alive with disease	57 (18.1)	23 (14.2)	24 (20.9)	12 (32.4)	
Death due to the disease	141 (44.9)	74 (45.7)	44 (38.3)	23 (62.2)	
Death due to other causes	16 (5.1)	11 (6.8)	4 (3.4)	1 (2.7)	
Lost during follow-up	15 (4.7)	6 (3.7)	8 (7)	1 (2.7)	

[a] Fisher's exact test.
[b] Kruskal–Wallis analysis of variance.
[c] χ^2 test.

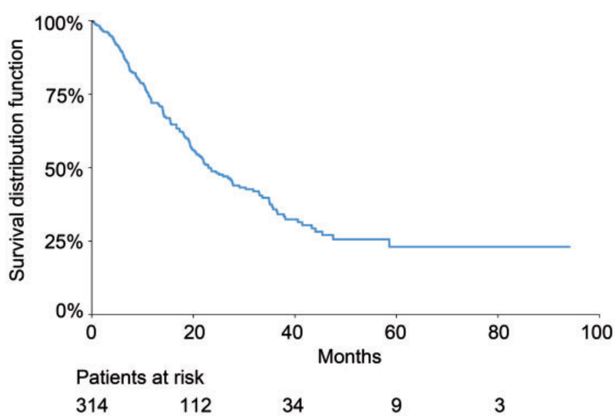

Figure 1: Overall survival curve.

Stage III or IV (P = 0.002) were factors that significantly predicted a poorer prognosis (Figs 2–5).

The multivariable Cox proportional hazard regression model found pathological disease Stage III–IV (P = 0.004, HR: 1.34; 95% CI: 1.09–1.64), EP/D and P/D (P = 0.006, HR for EP/D: 0.46; 95% CI: 0.29–0.74; HR for P/D: 0.52; 95% CI: 0.31–0.87), left-sided disease (P = 0.01, HR: 1.52; 95% CI: 1.09–2.12) and pathological T4 status (P = 0.0003, HR: 1.38; 95% CI: 1.14–1.66) to be independent significant predictors of survival.

DISCUSSION

The most effective treatment for MPM is controversial: It often involves a coordinated multimodality approach that incorporates surgery, systemic therapy (chemotherapy) and radiation [2]. Although the role and effectiveness of surgery in the treatment of MPM are still unclear, many surgeons think that the goal of every operation is to leave the patient in a state of no evidence of disease by accomplishing an MCR with the goal to improve long-term outcome in these patients [13]. The best way to accomplish this goal is, however, controversial, because a surgical standard of care for patients with MPM has not been established. Two surgical approaches are used: The lung-sacrificing operation (EPP) is highly standardized and the lung-sparing operation (P/D) is wildly variable with respect to extent (completeness of resection) but also with nomenclature [5]. The first report of pleurectomy in the treatment of MPM was by Martini *et al.* [6] in 1975, who described outcomes of parietal pleurectomy followed by external radiation and systemic chemotherapy in 14 patients: the median survival was 16 months. A year later, this series was expanded to include 33 patients with MPM who had a median survival of 21 months [14]. Since then, a number of non-randomized studies have demonstrated the feasibility and the safety of P/D for MPM with several different multimodality schemes involving induction and adjuvant treatments [5, 15, 16]. A potential disadvantage of P/D is the theoretically less cytoreductive capacity compared with EPP; in particular, the effectiveness and radicality of P/D in patients with advanced MPM is one of the main controversial points. Friedberg *et al.* [17] reported an MCR rate of 97% and a median survival of 21 months in their series of radical pleurectomy with intraoperative photodynamic therapy for advanced MPM. On the basis of their results, they theorized that MCR could be achieved with radical pleurectomy in all patients with MPM in whom MCR could be achieved with EPP. A similar finding was reported by Nakas *et al.* [18] in locally advanced (T3–4) non-sarcomatoid MPM. Bolukbas *et al.* [19], on the other hand,

Table 3: Predictors of death on univariable and multivariable analysis

Clinical factor	Survival median (95% CI) (months)	Univariable Cox analysis (stepwise forward selection)			Multivariable Cox analysis (stepwise forward selection[a])					
					MODEL I[b]			MODEL II[b]		
		P-value	HR	95% CI	*P*-value	HR	95% CI	*P*-value	HR	95% CI
Gender: male vs female	F 32.9 (20.2–45.4) M 22.0 (18.5–27.6)	0.12	1.38	0.92–2.08						
Side: left vs right	R 25.0 (20.2–35.5) L 21.8 (15.4–30.3)	0.02	1.46	1.05–2.02	0.01	1.54	1.10–2.15	0.01	1.52	1.09–2.12
Neoadjuvant CT: yes vs no	No 23.5 (19.4–36.4) Yes 22.9 (19.0–30.3)	0.24	1.22	0.88–1.68						
Type of surgery		0.003			0.02			0.006		
EP/D	27.3 (21.8–34.9)		0.47	0.30–0.74		0.51	0.32–0.81		0.46	0.29–0.74
P/D	25.8 (19.8–35.7)		0.48	0.29–0.79		0.56	0.34–0.94		0.52	0.31–0.87
Partial pleurectomy	11.1 (9.0–18.3)		Reference			Reference				
Histology		0.19								
Epithelial	E 24.5 (20.6–33.0)		Reference	0.93–4.27						
Biphasic	B 10.2 (0.7–25.8)		1.99	0.83–1.92						
Sarcomatoid	S 19.0 (15.4–43.3)		1.27	0.10–5.07						
Desmoplastic	D ne		0.70							
Epithelioid vs non-epithelioid	E 24.5 (20.6–33.0) NE 19.0 (14.2–27.6)	0.13	0.75	0.52–1.09						
pT Stage (values entered as severity levels)	T0 ne T1 23.6 (15.4–ne) T2 26.8 (20.3–58.6) T3 23.5 (19.3–31.8) T4 11.1 (6.2–18.5)	0.0002	1.41	1.18–1.69				0.0003	1.38	1.14–1.66
pN Stage (values entered as severity levels)	N0 27.3 (20.6–35.0) N1 19.8 (4.2–ne) N2 19.6 (15.4–26.8) N3 ne	0.03	1.25	1.02–1.52						
Pathological IMIG stage (values entered as severity levels)	S0 ne S1 37.9 (15.4–ne) S2 30.3 (19.4–ne) S3 20.2 (17.9–25.8) S4 19.6 (3.1–ne)	0.002	1.36	1.11–1.65	0.004	1.34	1.09–1.64			
Adjuvant radiotherapy: yes vs no	No 21.5 (14.2–31.8) Yes 23.0 (19.3–35.1)	0.11	0.73	0.50–1.07						

CI: confidence interval; CT: computed tomography; EP/D: extended pleurectomy/decortication; IMIG: International Mesothelioma Interest Group; AIC: Akaike information criteria; ne: not evaluable.

[a]Variables with $P < 0.10$ based on univariable calculations were entered into the multivariable models. In multivariable models, criteria for entering and staying were 0.10 and 0.05, respectively.

[b]Due to high correlation (Spearman's $R = 0.80$; $P < 0.0001$), pT stages and pathological stage were entered into separate models. AIC for best model showed similar values: Model I AIC = 1473.421; Model II AIC = 1464.277.

reported in patients with Stage III MPM treated with radical pleurectomy a lower MCR rate (61.9%) and a relatively high surgical mortality rate (4.8%), with a median survival of 21 months, comparable with the results from previous studies. The greatest recognized advantage of P/D is the lower rates of postoperative morbidity and mortality compared with EPP. Moreover, the preservation of the ipsilateral lung parenchyma has the potential to enhance quality of life and may allow greater tolerance of more aggressive adjuvant treatments, both initially and at the time of recurrence.

Two recent meta-analyses of a large number of studies comparing P/D to EPP suggest that P/D, in the context of multimodality therapy, is associated with a 2.5-fold lower short-term mortality rate (perioperatively and within 30 days), a greater than 50% reduction in postoperative morbidity, with an equivalent, if not greater, median overall survival [10, 11]. When analysing these reviews, however, one should take into account the biases that go into selecting a patient for one or the other procedure, the retrospective nature of most of the studies, the imbalanced patient characteristics and the varying adjuvant treatments used. In a recent editorial, Raja Flores [20] pointed out that attention to the recent general shift in surgery for MPM from EPP to P/D after a large comparative multicentre study by experienced mesothelioma surgeons failed to demonstrate significant survival differences between the 2 procedures [9]. He commented that 'the data suggest that the primary goal of surgery should not just be to obtain an MCR (R1) at the expense of pneumonectomy. More realistic goals should include the removal of as much tumor as possible while avoiding pneumonectomy, lung re-expansion, prevention of fluid reaccumulation, while minimizing morbidity and mortality. On the basis of the currently available data the equation tips in favor of P/D rather than EPP'. Many MPM centres in Europe and some in North America and Japan are currently performing P/D with curative intent [9, 21, 22]; moreover,

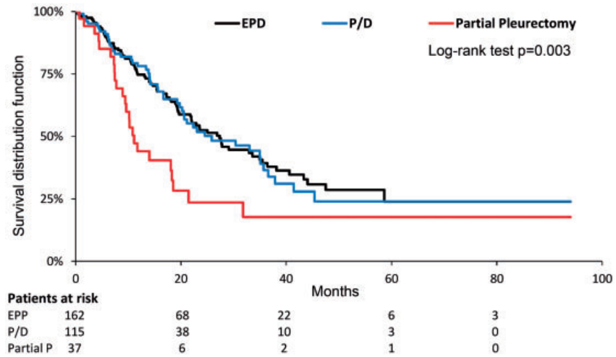

Figure 2: Survival curves based on type of surgical intervention.

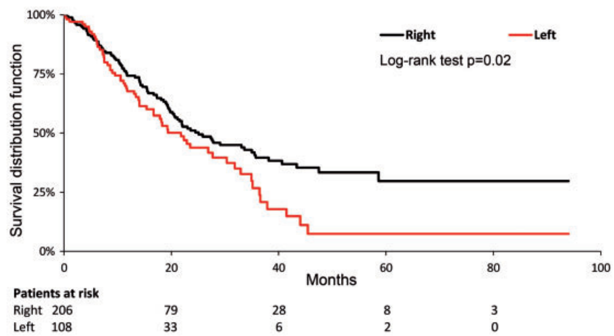

Figure 3: Survival curves based on sidedness of disease.

a MARS-II trial is currently underway to compare P/D versus best medical therapy [23].

If one looks at the current literature, one notes that pleurectomy-related procedures in various studies differ between institutions in terms of therapeutic intent, surgical technique and definition [5, 9–11, 18]. To date, no prospective study has evaluated the operative results in terms of the extent of the pleurectomy. A recent systematic review by Cao *et al.* [5] assessed the outcome of 1916 patients with MPM by analysing 34 studies and stratifying the surgical approach by the extent of the pleurectomy. Although detailed statistical analyses were not possible due to a lack of data, median overall and disease-free survival outcomes appeared to be longer in patients who had EP/D compared with those who had P/D and partial pleurectomy (the reported middle 2 quartile survival ranges were 15–25 months for EP/D, 12–18 months for P/D and 9–13 months for partial pleurectomy). The possible explanation may be related to the increased ability to achieve MCR by removing the diaphragm and pericardium when these areas are affected by tumours. Additionally, the results of this review suggested a similar perioperative mortality outcome between different P/D techniques, but a trend towards higher morbidity and length of hospitalization for patients who underwent EP/D was shown.

The results of our series are slightly different because the short- and long-term outcomes were similar between EP/D and P/D. Indeed, patients receiving EP/D or P/D (with no difference between these 2 procedures: log-rank test $P = 0.75$) had a significant survival advantage compared with those who had a partial pleurectomy. In our study, we observed a perioperative mortality rate of 2.2%, which was slightly lower than the average 4% (range, 0–25%) reported in the review of Teh *et al.* [24], who analysed the data of 1270 patients undergoing P/D for MPM from 26 series.

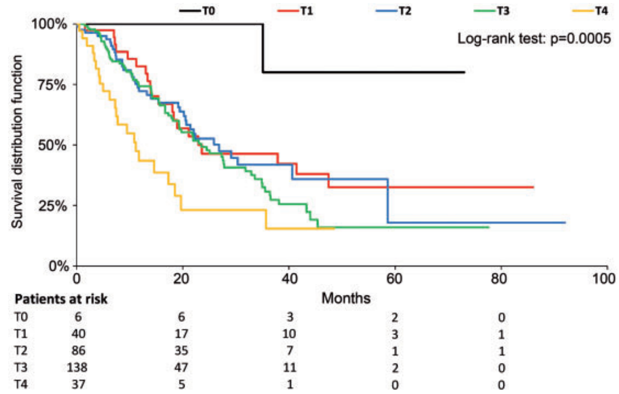

Figure 4: Survival curves based on pathological T status.

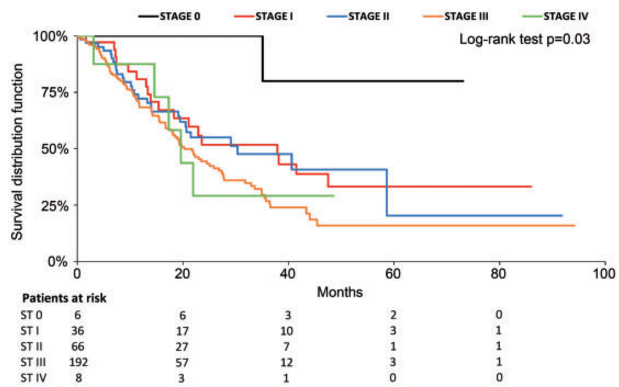

Figure 5: Survival curves based on pathological stage of disease.

No differences in perioperative mortality rates between the 3 procedures were observed in our series, but a significantly higher rate of major complications was associated with EP/D and P/D compared with partial pleurectomy. The poor survival results observed in the group of patients receiving partial pleurectomy raise the question as to the opportunity and ability to perform this type of operation. Also, the MesoVATS trial found no benefit for minimally invasive partial cytoreduction compared with pleurodesis [25]. These authors reported a 50–60% 1-year overall survival rate in both groups (median survival, 13 months), with worse survival in higher risk patients undergoing thoracoscopic partial pleurectomy. The palliative role of partial pleurectomy is debatable and not clearly demonstrated in the literature in terms of the improvement of quality of life, effectiveness for pain and control or reduction of pleural effusion.

Our study confirmed that the selection criteria are crucial in MPM patients: As in the majority of published series [2, 3, 9, 13, 26], advanced T status and advanced pathological stage were significant predictors of worse survival. Non-epithelial histology, male gender and nodal involvement were also associated with a poor outcome.

We also found that the side on which the tumour occurs was a predictor of prognosis, with the right-sided operation associated with a significantly prolonged survival. The reasons are unclear. We may hypothesize that the performance of cytoreduction on the right side, where the pleural cavity is larger than on the left, could be better, just as the potential for effective adjuvant radiotherapy is lower on the left side due to the presence of the heart.

Limitations

This study has the following limitations:

1. Its retrospective design, its uncontrolled nature and the associated selection and information biases.
2. The classification of the type of operation based on the review of the description of operative charts, which prevented us from collecting reliable data about the rate of MCR.
3. The survival calculation made from the day of surgery and not from the day of diagnosis or the beginning of multimodality treatment. Some of our patients, particularly those who had received chemotherapy before surgery, had been diagnosed and received treatments several months before the surgical intervention. If these factors are taken into consideration, the actual median survival for the patients from diagnosis will be greater than what we report in this study.
4. The heterogeneity among multimodality treatments, with some centres preferring induction chemotherapy and others favouring adjuvant chemotherapy.
5. The data collected from a multi-institutional (11 Italian centres) database. Using data from such widely scattered sources is a limitation, but, in our opinion, it is also one of the strengths of this study, because it covers a broad national experience that include centres with different surgical experiences and different volumes of activity. For this reason, the reported results are 'reproducible'.

CONCLUSIONS

In conclusion, pleurectomy–decortication is a valid operative option in MPM leading to good survival rates in selected patients, with an acceptable operative mortality rate. Partial pleurectomy, advanced pathological stage and T status and left-sided disease are associated with a poor prognosis. In our experience, EP/D and P/D showed similar outcomes; a partial pleurectomy leaving gross tumour behind had no impact on survival and should be carefully considered only in those cases in which a palliative role may be clearly desired.

Conflict of interest: none declared.

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