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ORIGINAL ARTICLE

Cost-effectiveness of indwelling pleural catheter compared with talc in malignant pleural effusion

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ABSTRACT

Background and objective: **Malignant pleural effusion is associated with morbidity and mortality. A randomized controlled trial previously compared clinical outcomes and resource use with indwelling pleural catheter (IPC) and talc pleurodesis in this population. Using unpublished quality of life data, we estimate the cost-effectiveness of IPC compared with talc pleurodesis.**

Methods: **Healthcare utilization and costs were captured during the trial. Utility weights produced by the EuroQol Group five-dimensional three-level questionnaire and survival were used to determine quality-adjusted life-years (QALYs) gained. The incremental cost-effectiveness ratio (ICER) was calculated over the 1-year trial period. Sensitivity analysis used patient survival data and modelled additional nursing time required per week for catheter drainage.**

Results: **Utility scores, cost and QALYs gained did not differ significantly between groups. The ICER for IPC compared with talc was favorable at $US10 870 per QALY gained. IPC was less costly with a probability exceeding 95% of being cost-effective when survival was <14 weeks, and was more costly when 2-h nursing time per week was assumed for catheter drainage.**

Conclusion: **IPC is cost-effective when compared with talc, although substantial uncertainty exists around this estimate. IPC appears most cost-effective in patients with limited survival. If significant nursing time is required for catheter drainage, IPC becomes less likely to be cost-effective. Either therapy may be considered as a first-line option in treating malignant pleural effusion in patients without history of prior pleurodesis, with consideration for patient survival, support and preferences.**

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SUMMARY AT A GLANCE

This is the first cost-effectiveness analysis performed alongside a randomized controlled trial comparing indwelling pleural catheters with talc pleurodesis for treating patients with malignant pleural effusions, and it provides clinically relevant recommendations regarding the cost-effective use of these therapies.

Clinical trial registration: ISRCTN87514420 at isrctn.com

Key words: chest tubes, cost-effectiveness analysis, palliative care, pleural effusion malignant, pleurodesis.

Abbreviations: ECOG, Eastern Cooperative Oncology Group; EORTC QLQ-C30, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire – Core Questionnaire; EQ-5D-3L, EuroQol Group five-dimensional three-level questionnaire; ICER, incremental cost-effectiveness ratio, IPC, indwelling pleural catheter; IQR, interquartile range; LDH, Lactate Dehydrogenase; LENT, pleural fluid lactate dehydrogenase, Eastern Cooperative Oncology Group (ECOG) performance score (PS), neutrophil-to-lymphocyte ratio and tumour type; MCMC, Markov Chain Monte Carlo; NT-proBNP, N-terminal pro-brain natriuretic peptide; QALY, quality-adjusted life-year; TIME2, The Second Therapeutic Intervention in Malignant Effusion; VAS, visual analogue scale.

INTRODUCTION

Malignant pleural effusion is a common clinical entity causing 42–77% of exudative effusions with more than 150 000 cases annually in the United States.[1] Debilitating dyspnoea occurs in almost all patients with malignant pleural effusion.[2] The British Thoracic Society currently recommends talc pleurodesis as first-line treatment for patients with malignant pleural effusion. Treatment with an indwelling pleural catheter (IPC) is recommended as an alternative to talc pleurodesis only in selected patients.[3] Recently, The Second Therapeutic Intervention in Malignant Effusion (TIME2) randomized controlled trial compared the clinical efficacy of IPC versus talc pleurodesis in treating malignant pleural effusion.[4] Both treatments resulted in significant improvement in the primary clinical outcome of subjective patient dyspnoea, with IPC treatment also resulting in decreased length of hospital stay and decreased additional pleural procedures, but more adverse events. A costing study performed alongside the clinical trial showed no significant difference in overall costs between IPC and talc pleurodesis.[5] IPC was less costly when patient survival was limited (<14 weeks), and more costly when patients were assumed to require 2 h of nursing time per week. Using quality of life data not previously published and combining it with survival, we estimate the quality-adjusted life-year of patients enrolled in the TIME2 trial and report the incremental cost-effectiveness of IPC compared with talc pleurodesis in patients with malignant pleural effusion. Some of the results of this study have been previously reported in the form of an abstract.[6]

METHODS

The design and methods of the TIME2 clinical trial and costing study have been described in detail previously.[4,5] The TIME2 is a multicentre, randomized controlled trial comparing IPC with talc pleurodesis for patients with malignant pleural effusion.[4] Between April 2007 and February 2011, seven centres across the UK randomized 106 patients with confirmed malignant pleural effusion to either IPC (Rocket Medical, Washington, UK) or talc (chest tube and talc slurry) pleurodesis. Ethical and regulatory approval for the study was obtained from the Milton Keynes Research Ethics Committee before recruitment commenced (REC number: 07/Q1603/2), and all patients provided written informed consent prior to randomization. The clinical trial is registered at www.isrctn.com (No.: ISRCTN87514420). Most IPCs were inserted in the outpatient setting while all talc pleurodesis was performed in hospital. Patients with chylothorax, previous lobectomy/pneumonectomy and attempted pleurodesis, and pleural infection were excluded from the study. The primary outcome measure was mean daily dyspnoea. Secondary outcomes included: adverse events, frequency of drainage, nights spent in hospital, all-cause mortality and health-related quality of life assessed by the EuroQol Group five-dimensional three-level questionnaire (EQ-5D-3L) (not previously reported).

Cost-effectiveness analysis

We conducted a cost-effectiveness analysis from the perspective of the healthcare payer using costs and quality of life data collected alongside the clinical trial. The median survival in this patient population was 200 days (14% were alive at 1 year); therefore, no additional modelling of costs or quality of life beyond the trial period was required. The cost-effectiveness analysis was performed over the 1-year study period thus discounting was not performed. Direct healthcare-related costs were included in the analysis. Non-medical costs (i.e. patient time and travel costs, as well as costs related to lost productivity) were not included. Costs in 2011 UK pounds were inflated to 2014 values using the UK Consumer Price Index (1.059).[7] The Organisation for Economic Co-operation and Development Purchasing Power Parity Index (2013) was used to convert costs in UK pounds to US dollars.[8] Resource utilization and valuation have been fully described previously.[5]

Survival and health-state preference

The EQ-5D-3L self-administered questionnaire evaluates five patient attributes: mobility, self-care, usual activity, pain/discomfort and anxiety/depression on a three-point scale (no problem, some problems or major problems). Patient responses to the EQ-5D-3L produced scores that were then converted to utility weights, ranging from 0 (death) to 1.0 (perfect health), using the UK valuation set at each follow-up period.[9] Negative values represent health states deemed worse than death. Quality-adjusted life-years (QALYs) were estimated by combining survival and utility scores derived for each patient at baseline and each follow-up period (2, 4, 6, 10, 14, 18, 22, 26, 39 and 52 weeks).

Statistical analysis

All analyses were calculated on an intention to treat basis. We used non-parametric bootstrapping with 1000 replications to derive a 95% CI for the incremental mean cost difference and mean QALY difference between the two groups. For the bootstrap estimate, we used the percentile method. We randomly sampled with replacement, generating 1000 random data sets. Difference in mean costs and mean QALYs for each of the 1000 data sets was calculated, ranked from lowest to highest and the difference in mean cost and QALY for the 26th and 975th ordered values defined the 95% CI.

Cost-effectiveness was calculated as the ratio of the difference in costs between the IPC group and the talc pleurodesis group divided by the difference in QALYs gained between the two groups. Cost-effectiveness ratios were computed for the 1-year trial period. To describe the uncertainty in the estimates of cost-effectiveness, we constructed cost-effectiveness acceptability curves, stating the probability that IPC was cost-effective at a given willingness to pay threshold ($US50 000/QALY).

Missing data

Multiple imputation was used to estimate missing utility scores and drainage volumes in patients alive during the trial follow-up period in order to reduce potential bias and increase precision.[10] The method predicts missing values by iteratively estimating regression models on observed and imputed data.[11] Multiple imputation was conducted using PROC MI within SAS 9.2 (SAS Institute Inc, Cary, North Carolina, USA), and the Markov Chain Monte Carlo (MCMC) algorithm was chosen to draw imputed values due to the non-monotone missing patterns. We generated 100 imputed data sets to ensure that subsequent analyses produce a reliable and replicable estimate of the posterior distribution around missing values. The distribution of imputed data was compared with the data before multiple imputation. Comparisons of EQ-5D-3L data and drainage data before and after multiple imputation are provided in Figures S1 and S2 (Supplementary Information). The proportion of missing EQ-5D-3L data and drainage data is given in Table S1 (Supplementary Information). All statistical analyses were performed using Stata 11.2 (StataCorp LP, College Station, Texas, USA).

Sensitivity analysis

In our previously published costing study, a significant change in the mean cost difference between the IPC and talc pleurodesis groups was seen with patient survival (> and <14 weeks), and by modelling nursing time required for IPC drainage; therefore, this sensitivity analysis was also performed in the cost-effectiveness analysis.

RESULTS

Baseline characteristics and mortality between the two groups in the clinical trial were similar (Table 1).[4]

Quality of life

The EQ-5D-3L utility scores were missing in 2%, 11%, 24% and 28% of IPC patients and 2%, 22%, 25% and 41% of talc patients at baseline, 14 weeks, 26 weeks and 1 year, respectively (Table S1, Supplementary Information). Mean (SD) utility scores were similar at baseline, 0.59 (0.17) in the IPC group and 0.61 (0.17) in the talc group (P = 0.65), and during follow-up, 0.79 (0.16) versus 0.67 (0.32) (P = 0.30) for the IPC and talc groups, respectively (Fig. 1, Table 2). Individual responses to the five attributes evaluated in the EQ-5D-3L questionnaire are provided in Tables S2 and S3 (Supplementary Information). At 1 year, the mean QALYs gained (SD) in the IPC and talc groups were 0.35 (0.296) and 0.33 (0.303), with a mean QALY difference of 0.026 (95% CI: −0.09 to 0.13; P-value = 0.64) (Table 3).

Cost-effectiveness

Mean total cost (SD) for managing patients with IPC compared with talc did not differ significantly. The estimated incremental cost-effectiveness ratio (ICER) for IPC as compared with talc during the 52 weeks following initiation of treatment was $US10 870 per QALY gained (Table 3). The cost-effectiveness plane plots all the 1000 bootstrapped estimates of incremental costs and QALYs (ICERs) between the IPC and talc groups. Point estimates are situated in all four quadrants of the cost-effectiveness plane, reflecting uncertainty around the baseline cost-effectiveness ratio (Fig. 2). At a threshold of £30 000 ($US42 947) per QALY, the probability that IPC is cost-effective compared with talc is approximately 65% (Fig. 3).

Table 1 Baseline demographic data and mortality for 106 patients with malignant pleural effusion

	IPC	Talc
Number	52	54
Age, mean (SD), years	67 (11)	67 (12)
Male:female (%male)	23:29 (44)	23:31 (43)
Type of malignancy		
Breast	16	11
Lung	9	16
Mesothelioma	6	5
Other†	21	21
VAS dyspnoea, mean (SD), mm	62 (22)	55 (26)
VAS chest pain, mean (SD), mm	29 (30)	22 (29)
Size of effusion on chest radiograph, % hemithorax (SD)	51 (23)	49 (25)
EORTC QLQ-C30		
Global health status % (SD)	37 (23)	37 (20)
Inpatient:outpatient at enrolment (% inpatient)	19:33 (35)	22:31 (42)
Mortality		
Median survival, days (IQR)	153 (73–288)	200 (39–392)

Adapted from Davies *et al.*,[4] with permission.

†Other malignancies were colorectal (four IPC:three talc), ovarian (two IPC:five talc), adenocarcinoma of unknown primary (four IPC: two talc), renal (three IPC:two talc), sarcoma (one IPC:two talc), thymoma (one IPC:one talc), oesophageal (two IPC), peritoneal (one IPC:one talc), prostate (one IPC), ampullary (one IPC), leiomyosarcoma (one IPC), melanoma (one talc), myeloma (one talc), nasopharyngeal (one talc) and unknown (one IPC:one talc). One patient in the talc group died prior to enrolment so no demographic data was available.

EORTC QLQ-C30, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire – Core Questionnaire; IPC, indwelling pleural catheter; IQR, interquartile range; SD, standard deviation; VAS, visual analogue scale.

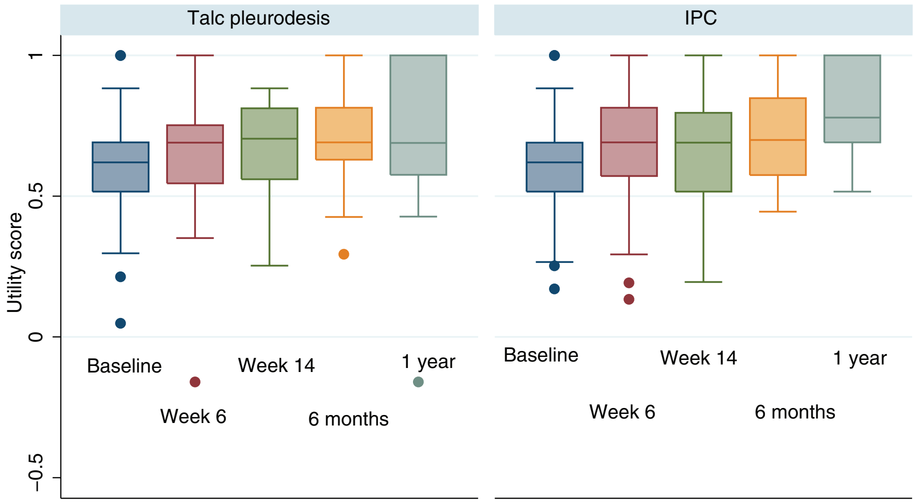

Figure 1 Box and whisker plots of indwelling pleural catheter (IPC) and talc EQ-5D-3L utility scores at various follow-up intervals. The line within each box represents the median. The top and bottom of the boxes represents the 75th and 25th percentiles. The top and bottom of the whiskers represents the 95th and 5th percentiles. Utility scores were similar at baseline and throughout the trial follow-up period between the groups. Each individual group's utility scores did not change significantly during the trial follow-up period (, baseline; , week 6; , week 14; , 6 months; , 1 year).

Table 2 Quality of life as measured by the EQ-5D-3L utility index in the IPC and talc groups

Time from randomization	IPC mean EQ-5D-3L (SD)	Alive IPC patients (*n*)	Talc mean EQ-5D-3L‡ (SD)	Alive talc patients (*n*)
Baseline	0.594 (0.17)	52	0.608 (0.17)	54
Week 2	0.629 (0.25)	51	0.656 (0.20)	45
Week 4	0.681 (0.16)	48	0.668 (0.22)	41
Week 6	0.681 (0.21)	43	0.659 (0.22)	40
Week 10	0.679 (0.22)	39	0.702 (0.20)	35
Week 14	0.684 (0.20)	36	0.679(0.16)	32
Week 18	0.699 (0.20)	35	0.738 (0.20)	32
Week 22	0.706 (0.20)	30	0.659 (0.21)	31
Week 26	0.727 (0.18)	29	0.714 (0.17)	28
9 months	0.683 (0.23)	23	0.717 (0.22)	22
1 year	0.788 (0.16)	18	0.674 (0.32)	18

EQ-5D-3L, EuroQol Group five-dimensional three-level questionnaire; IPC, indwelling pleural catheter; SD, standard deviation.

Sensitivity analysis

In patients with limited survival (<14 weeks), mean total cost was lower in the IPC group than in the talc group, \$US2693 (2095) versus \$US4563 (2975), resulting in a significant mean difference of −\$US1870 (95% CI: −3358 to −176). The QALYs gained in the IPC and talc groups were similar with a mean QALY difference of 0.024 (95% CI: −0.01 to 0.05) (Table 3). In this subgroup of patients, the probability that IPC is cost-effective compared with talc at a threshold of £30 000 (\$US42 947) per QALY exceeds 95% (Figs S3, S4 (Supplementary Information)). When patients in the IPC group were assumed to require 2 h of nursing care per week, the mean total cost was higher in the IPC group than in the talc group, \$US6416 (5993) versus \$US4375 (4242), resulting in a significant mean difference of 2041 (95% CI: 117–4280). Under this scenario, the estimated ICER was \$US77 213 per QALY gained (Table 3), and the probability that IPC is cost-effective compared with talc is approximately 35% at a threshold of £30 000 (\$US42 947) per QALY (Figs S5, S6 (Supplementary Information)) In patients with both limited survival (<14 weeks) and assumed to require 2 h of nursing care per week, the mean total cost did not significantly differ between the IPC and talc groups (Table 3). Under this scenario, the probability of IPC being cost-effective compared with talc at a threshold of £30 000 (\$US42 947) per QALY exceeds 95% (Figs S7, S8 (Supplementary Information)).

DISCUSSION

Our study is the first cost-effectiveness analysis to compare IPC with talc pleurodesis in the treatment of malignant pleural effusion alongside a randomized controlled trial. The baseline ICER for IPC compared with talc pleurodesis is favourable, but a significant degree of uncertainty exists around this estimate. This finding is not unexpected given that, on average, the difference between IPC and talc pleurodesis with respect to costs, survival and QALYs is not significant. Using the cost-effectiveness acceptability curve to illustrate the uncertainty around the incremental cost-effectiveness estimate, it is clear that the probability of IPC being cost-effective compared with talc pleurodesis increases as the willingness to pay for health gains increases. However, beyond a threshold of £30 000 (\$US42 947) per QALY, the probability that IPC remains cost-effective relative to talc pleurodesis never exceeds 65%.

Table 3 Total costs (US $US 2014) and QALYs, mean difference for costs and QALYs, and ICER for all patients, those surviving <14 weeks and those requiring 2-h nursing time

	Variable	IPC Mean (SD)	Talc Mean (SD)	Mean difference Mean (95% CI)	*P*-value
All patients	Total costs ($US)	4591 (5300)	4303 (4107)	287 (−1428 to 2430)	0.77
	QALY gained	0.354 (0.296)	0.328 (0.303)	0.026 (−0.085 to 0.134)	0.64
	Mean ICER for IPC (95% CI)	$US10 870/QALY			
Survival < 14 weeks†	Total costs ($US)	2693 (2095)	4563 (2975)	−1870 (−3358 to −176)	0.04
	QALY gained	0.064 (0.052)	0.041 (0.039)	0.024 (−0.005 to 0.05)	0.13
	Mean ICER for IPC (95% CI)	−$US79 303/QALY			
Nursing care = 2 h per week	Total costs ($US)	6416 (5993)	4375 (4242)	2041 (117 to 4280)	0.04
	QALY gained	0.354 (0.296)	0.328 (0.303)	0.026 (−0.085 to 0.134)	0.64
	Mean ICER for IPC (95% CI)	$US77 213/QALY			
Survival < 14 weeks and nursing care = 2 h per week	Total costs ($US)	3323 (2141)	4642 (2999)	−1317 (−3008 to 238)	0.18
	QALY gained	0.064 (0.052)	0.041 (0.039)	0.024 (−0.005 to 0.05)	0.13
	Mean ICER for IPC (95% CI)	−$US55 889/QALY			
Survival > 14 weeks	Total costs ($US)	5511 (6116)	4524 (4788)	987 (−1411 to 3630)	0.48
	QALY gained	0.495 (0.261)	0.539 (0.226)	−0.044 (−0.159 to 0.076)	0.48
	Mean ICER for IPC (95% CI)	−$US22 299/QALY			

†Sixteen (31%) IPC patients and 22 (41%) talc patients survived <14 weeks. The cost-effectiveness plane and cost-effectiveness acceptability curve for patients with survival >14 weeks are shown in Figures S9 and S10 (Supplementary Information). Values also expressed in 2014 UK pounds are shown in Table S4 (Supplementary Information).

CI, confidence interval; ICER, incremental cost-effectiveness ratio; IPC, indwelling pleural catheter; QALY, quality-adjusted life-year; SD, standard deviation.

As would be expected, if nursing time required to drain the IPC is assumed to be 2 h per week (in the TIME2 trial, patients and caregivers drained the IPC without nurse assistance), then IPC is not considered to be cost-effective, particularly at a willingness to pay threshold of £30 000 ($US42 947) per QALY (Figs S5, S6 (Supplementary Information)). Interestingly, and similar to other studies which have performed decision modelling around the cost-effectiveness of IPC versus talc pleurodesis,[12,13] our study suggests that IPC is cost-effective relative to talc pleurodesis in patients with limited survival (<14 weeks). For those with both limited survival and assumed nursing care requirements, IPC remains favourable compared with talc, and the probability of IPC being cost-effective at any willingness to pay exceeds 95% (Figs S7, S8 (Supplementary Information)).

The results of this cost-effectiveness analysis support the recommendations made in our previously reported costing study.[5] Either IPC or talc pleurodesis may be used as a first-line option in the treatment of malignant pleural effusion after considering patient preferences based on the risks and benefits of both treatments. All other factors being equal, we recommend the following: (i) IPC should be considered the most cost-effective treatment when expected patient survival is <14 weeks, regardless of intensity of nursing care required for drainage and (ii) talc pleurodesis should

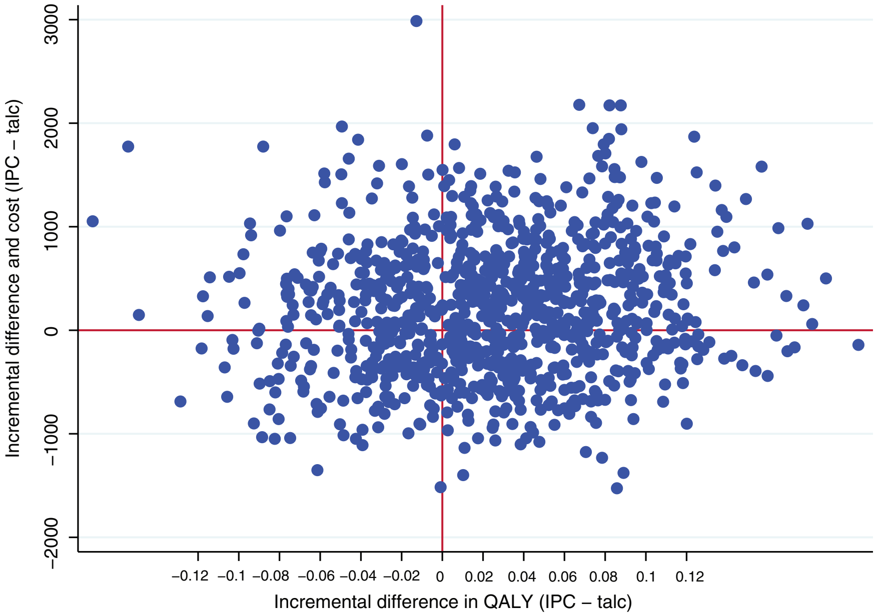

Figure 2 Cost-effectiveness plane for all patients. Thousand bootstrapped point estimates of incremental costs and quality-adjusted life-years (QALYs) (incremental cost-effectiveness ratios, ICERs) between the indwelling pleural catheter (IPC) and talc groups are plotted. In the left upper quadrant of the plane, point estimates reflect when IPC is more costly and less effective (mean negative QALY difference) than talc (i.e. inferior strategy). In the right lower quadrant, point estimates reflect when IPC is cheaper and more effective than talc (i.e. dominant strategy). Estimates in the right upper and left lower quadrants reflect when IPC is either more effective and more costly than talc or less effective and less costly than talc, respectively. Point estimates are situated in all four quadrants of the cost-effectiveness plane, reflecting uncertainty around the baseline cost-effectiveness ratio.

be considered the most cost-effective treatment when patients will require two or more hours of nursing care per week for drainage and catheter care.

Previous cost-effectiveness analyses using observational data suggest the cost-effectiveness of IPC compared with talc depends on patient survival[12,13]; however, predicting survival in those with malignant pleural effusion is challenging. Lumachi *et al.* found that survival after talc pleurodesis was independent of age, gender, type of malignancy and amount of pleural fluid; however, this study was likely underpowered.[14] More recently, Clive *et al.* demonstrated effusion size, ECOG performance score, pleural fluid LDH, serum neutrophil-to-lymphocyte ratio, serum NT-proBNP and malignant cell type to be independently associated with survival.[15] A predictive model using some of these

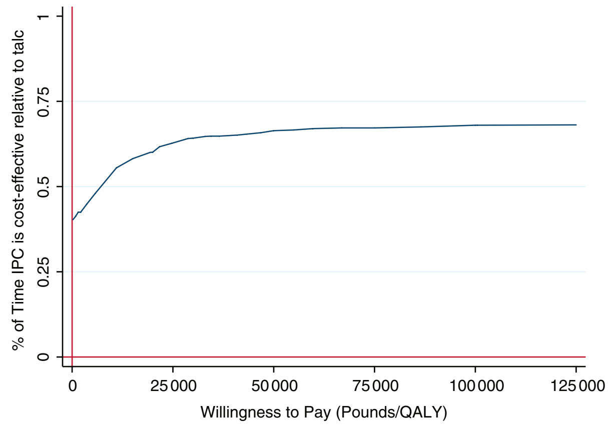

Figure 3 Cost-effectiveness acceptability curve for all patients. The probability of indwelling pleural catheter (IPC) being cost-effective compared with talc is plotted against the willingness to pay for IPC. As the willingness to pay for IPC increases, the probability of IPC being cost-effective compared to talc increases. At a threshold of £30 000 ($US42 947) per quality-adjusted life-year (QALY), the probability of IPC being cost-effective compared with talc is 65%.

variables (LENT score) divided patients into low-, moderate- and high-risk groups with median survivals of 319, 130 and 44 days, respectively. The LENT score was subsequently validated in a separate patient cohort. This prognostication tool may help guide decisions regarding treatment in patients with malignant pleural effusion. In the TIME2 trial, patients were included in the trial if expected survival was more than 3 months based on ECOG score.[4] Despite this intention, there were still a significant proportion of patients who survived <3 months and in this group, IPC was found to be a cost-effective management strategy.

Several limitations exist for this study. The sample size was powered to detect clinically important outcomes, but not necessarily differences in cost-effectiveness. Our study still provides much needed information regarding the quality of life, survival, costs and cost-effectiveness of these two therapies. Some resource use and costs may have been missed such as those for oxygen and morphine for end-stage dyspnoea, and non-intervention-related hospitalizations. However, the impact of these variables on overall costs is unlikely to be significant and did not likely differ between the two groups. The study perspective was limited to that of the healthcare payer and therefore did not include time costs of patients, caregiver burden costs, costs associated with productivity loss and travel costs. This may be important as our study assumed that the patient and family would be performing the catheter drainage and dressing changes. Furthermore, this may also be important in more rural jurisdictions where patient travel time to clinical care is increased. The effect on costs from increased home nursing care for IPC drainage was modelled in the sensitivity analysis, as home nursing care was not a routine part of care during the trial. One might expect that patients requiring increased nursing care at home would have differences in quality of life compared with those patients who are more independent, which could affect the incremental cost-effectiveness of IPC compared with talc. Finally, the utilization and valuation of resources required for IPC and talc may differ between countries. Therefore, our recommendations may not be easily generalizable outside of the UK where the study was performed.

In conclusion, the cost-effectiveness of IPC is favourable when compared with talc pleurodesis, although substantial uncertainty exists around this estimate. In patients with limited survival, IPC is less costly and as a result, cost-effective compared with talc pleurodesis. We recommend that either IPC or talc pleurodesis be considered as a first-line option in the treatment of malignant pleural effusion in patients without a history of prior pleurodesis.

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Disclosure statement

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Supplementary Information

Additional supplementary information can be accessed via the *html* version of this article at the publisher's website.

Figure S1 Comparison of mean EQ-5D-3L data before and after multiple imputation.

Figure S2 Comparison of drainage data before and after multiple imputation.

Figure S3 Cost-effectiveness plane for patients with survival <14 weeks.

Figure S4 Cost-effectiveness acceptability curve for patients with survival <14 weeks.

Figure S5 Cost-effectiveness plane for patients assumed to require 2 h per week of nursing care.

Figure S6 Cost-effectiveness acceptability curve for patients assumed to require 2 h per week of nursing care.

Figure S7 Cost-effectiveness plane for patients with survival <14 weeks and assumed to require 2 h per week of nursing care.

Figure S8 Cost-effectiveness acceptability curve for patients with survival <14 weeks and assumed to require 2 h per week of nursing care.

Figure S9 Cost-effectiveness plane for patients with survival >14 weeks.

Figure S10 Cost-effectiveness acceptability curve for patients with survival >14 weeks.

Table S1 Proportion of missing EQ-5D-3L and drainage data in indwelling pleural catheter and talc groups.

Table S2 Proportion of alive indwelling pleural catheter patients in each level for the five attributes of the EQ-5D-3L questionnaire.

Table S3 Proportion of alive talc patients in each level for the five attributes of the EQ-5D-3L questionnaire.

Table S4 Total costs (UK pounds 2014) and quality-adjusted life-years (QALYs), mean difference for costs and QALYs and incremental cost-effectiveness ratio for all patients, those surviving <14 weeks and those requiring 2 h of nursing time.