# COST EFFECTIVENESS OF METAL STENTS IN PANCREATIC CANCER

Montero AJ[1], Meckley LM[2], Anene AM[3], Bentley TGK[3], Ortendahl JD[3], Martinez JM[4]
[1]Cleveland Clinic, [2]Boston Scientific Corporation, [3]Partnership for Health Analytic Research, LLC, [4]University of Miami

## Background

- Incidence of pancreatic cancer is 12.2 per 100,000[1]
- At diagnosis, >50% of patients have metastatic disease and up to 90% of patients present with obstructive jaundice. [1,2]
- ASGE guidelines recommend endoscopic stent placement, specifically:
  - Plastic stents for patients with estimated life expectancy of <6 months,
  - Metal stents for patients with estimated life expectancy of > 6 months.[3]
- Recent evidence from phase III trials demonstrates prolonged survival well beyond 6 months in patients treated with FOLFIRINOX and gemcitabine compared with current standards of care.[4]

## Objective

This analysis evaluated the cost effectiveness of initial metal vs. plastic stent placement in patients with locally-advanced pancreatic adenocarcinoma with biliary obstruction.

## Methods

### Overview

- Model type: Markov cohort
- Timeframe: Lifetime
- Cycle length: 1 month
- Perspective: 3rd party payer
- Clinical, cost and utility inputs derived from targeted review of published sources and expert opinion (Montero AJ and Martinez JM). Selected studies had endpoints from a population/clinical setting/oncologic and surgical treatment regimens that was most similar to the modeled patient population.
- Results were reported as:
  - Costs
  - Quality-adjusted life months
  - Life months
  - ICERs ($/life year and $/quality-adjusted life year)

### Table 1. Cost & Utility Weight Inputs

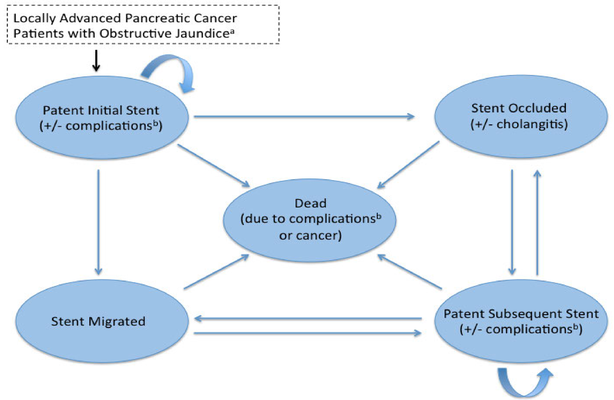
| Parameter | Cost ($) | | Utility | |
|---|---|---|---|---|
| | Value[a] | Source | Value | Source |
| Pancreatic Cancer | | | | |
| Locally Advanced (per month) | 5,056 | 5 | 0.61 | 6 |
| Metastatic (per month) | 27,076 | 7 | 0.61 | 6 |
| ERCP Procedure (Initial) | -- | | 0.18[c] | 8 |
| Metal Stent | 6,757 | 9 | -- | |
| Plastic Stent | 6,757 | 9 | -- | |
| ERCP Procedure (Subsequent)[b] | -- | | 0.18[c] | 8 |
| Metal Stent | 3,635 | 9 | -- | |
| Plastic Stent | 3,635 | 9 | -- | |
| ERCP Complications | -- | | -0.04[d] | 10 |
| Cholecystitis | 4,549 | 11 | -- | |
| GI Bleeding | 3,975 | 12,13 | -- | |
| Pancreatitis | 12,353 | 14 | -- | |
| Cholangitis | 9,723 | 15 | -0.04[d] | 10 |

[a] In 2012 US dollars.
[b] Migrated and occluded stents incur costs equivalent to those of subsequent ERCP procedures.
[c] Decrement applied for 3 days.
[d] Decrement applied for half of one cycle.

## Methods (cont.)

### Model Structure

- Patients entered model with locally advanced cancer
- Patients underwent endoscopic retrograde cholangiopancreatography (ERCP) with metal or plastic stent placement
- During each model cycle, patients were at risk of:
  - Complications (gastrointestinal bleeding, pancreatitis, cholecystitis, and cholangitis)
  - Stent migration or stent occlusion (with subsequent stent placement)
  - Progression to metastatic cancer
  - Death




[a] Patients can progress at any point from locally advanced to metastatic pancreatic cancer.
[b] Complications include gastrointestinal bleeding, pancreatitis, cholecystitis, and cholangitis.

### Table 2. Clinical Inputs

| Parameter | Estimate | Source |
|---|---|---|
| Pancreatic Cancer Mortality | | |
| Locally Advanced (median survival) | 16.9 months | 4,16 |
| Metastatic (median survival) | 11.1 months | 4 |
| Pancreatic Cancer Progression Rate[a] | 4.8% | 17 |
| Stent Migration Rate | | |
| Plastic Stent | 1.4% | 18 |
| Metal Stent | 1.4% | 18 |

[a] Monthly rate of progression from locally advanced to metastatic cancer.

### Table 2: Clinical Inputs (cont.)

| Parameter | Estimate | Source |
|---|---|---|
| Stent Occlusion Rate | | |
| Plastic Stent | 69.6% | 19 |
| Metal Stent | 55.4% | 19 |
| Cholangitis | | |
| Plastic Stent | 21.4% | 20 |
| Metal Stent | 7.0% | 20 |
| Cholangitis Mortality[b] | 14.0% | 22 |
| ERCP Complication Rate[c] | | |
| Cholecystitis | | |
| Plastic Stent | 0.0% | 19 |
| Metal Stent | 2.0% | 21 |
| GI Bleeding | | |
| Plastic Stent | 5.4% | 19 |
| Metal Stent | 0.5% | 21 |
| Pancreatitis | | |
| Plastic Stent | 8.9% | 19 |
| Metal Stent | 2.5% | 21 |
| ERCP Complication Mortality Rate[c,d] | 1.0% | 18-21 |
| Plastic Stent Patients: Subsequent Stent Exchanges | | |
| Following Routine Exchange: | | |
| Plastic Stent | 40% | 23 |
| Metal Stent | 60% | 23 |
| Following Occlusion or Migration: | | |
| Plastic Stent | 30% | 23 |
| Metal Stent | 70% | 23 |
| Routine Plastic Stent Exchange | Every 3 Months | 24 |

*ERCP, endoscopic retrograde cholangiopancreatography; GI, gastrointestinal.*
[b] Includes mortality due to cancer.
[c] Includes procedure- and stent placement-related complications.
[d] Mortality rate applies to cholecystitis, GI bleeding and pancreatitis.

## Results

- Patients with metal stents:
  - Had approximately **$1,500 lower costs** per patient over a lifetime versus patients with plastic stents.
  - Were estimated to have 0.32 months higher quality-adjusted life years than patients with plastic stents.[a]
  - Had fewer stents placed over a lifetime (1.4 vs. 2.8).
- Multivariate sensitivity analyses indicated that variation in input rates other than stent occlusion and the number of stent exchanges did not materially impact the results of the model.

[a]Quality-adjusted life years are a health economic measure and are not indicative of extended survival time.

### Table 3. Results: $/QALY

| | Cost | | Quality-adjusted life months | | ICER |
|---|---|---|---|---|---|
| | Total | Δ | Total | Δ | ($/QALY) |
| Metal Stents | $304,151 | - | 12.27 | - | - |
| Plastic Stents | $305,605 | $1,453 | 11.96 | -0.32 | **Dominated** |

*ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life year*

### Table 4. Results: Stent-related Outcomes

| | Total (per patient) | Proportion requiring 2nd stent | Median Months |
|---|---|---|---|
| Metal Stents | 1.37 | 28.0% | 10 |
| Plastic Stents | 2.82 | 88.5% | 3 |

## Conclusions

- Compared with plastic stents, placement of metal biliary stents at initial onset of obstructive jaundice in patients with stage III pancreatic adenocarcinoma provides a modest decrease in cost.
- Cost savings were due in part to fewer stents being placed when initially using metal stents (1.4 vs. 2.8).
- With the increased survival observed in recent trials of new oncologic treatments of pancreatic adenocarcinoma, including FOLFIRINOX and gemcitabine, the use of metal stents for biliary obstruction may become more common.

## Limitations

- References chosen to set clinical inputs were a targeted, but narrow subset of the available literature. Despite results from the above-stated sensitivity analyses, a selection bias resulting from the references used for clinical inputs cannot be excluded.
- There is uncertainty around many of the parameter estimates. Future studies will further evaluate the impact of this variation on cost and QALYs.
- Published data on quality of life was sparse, so utility weights for similar, but not identical, health conditions were applied.
- Cost inputs were based on United States data only.

## References

**1.** SEER Stat Fact Sheets: Pancreas Cancer 2013. **2.** Gouma *HPB (Oxford)* 2006. **3.** American Society of Gastrointestinal Endoscopy Practice Guidelines 2013 ; **4.** Conroy *N Engl J Med* 2011; **5.** Krzyzanowska *Int J Radiat Oncol Biol Phys* 2007; **6.** Heiberg *Support Care Cancer* 2013; **7.** O'Neill *Cancer* 2012; **8.** Jeurnink *Surg Endosc* 2012; **9.** Guidepoint 2012 Procedural Reimbursement Guide; **10.** Howard *Int J Technol Assess Health Care* 2006; **11.** Riall *J Am Coll Surg* 2010; **12.** Peery *Gastroenterology* 2012; **13.** HCUP-NIS cost-to-charge ratio 2009 file; **14.** Fagenholz *Pancreas* 2007; **15.** Chen *Clin Gastroenterol Hepatol* 2005; **16.** Buxbaum *JOP* 2011; **17.** Loehrer *J Clin Oncol* 2011; **18.** Bakhru *J Gastroenterol Hepatol* 2011; **19.** Yoon *Gastrointest Endosc* 2009; **20.** Adams *J Gastrointest Oncol* 2012; **21.** Gomez-Oliva *Surg Endosc* 2012; **22.** Pola *Dig Dis Sci* 2012; **23.** Expert opinion **24.** Kashab *Dig Dis Sci* 2012.

**ASCO Gastrointestinal Cancers Symposium, January 17, 2014, San Francisco, CA, USA.**
**This research was funded by Boston Scientific and conducted by Partnership for Health Analytic Research, LLC.**