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A Meta-Analysis of Complications following Deceased Donor Liver Transplant

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Abstract

Background—Liver transplantation is a complex surgery associated with high rates of postoperative complications. While national outcomes data are available, national rates of most complications are unknown.

Data Sources—A systematic review of the literature reporting rates of postoperative complications between 2002 and 2012 was performed. A cohort of 29,227 deceased donor liver transplant recipients from 74 studies was used to calculate pooled incidences were for 17 major postoperative complications.

Conclusions—This is the first comprehensive review of postoperative complications after liver transplantation and can serve as a guide for transplant and non-transplant clinicians. Efforts to collect national data on complications, such as through the National Surgical Quality Improvement Program, would improve the ability to provide patients with informed consent, serve as a tool for individual center performance monitoring, and provide a central source against which to measure interventions aimed at improving patient care.

Keywords

Liver Transplantation; Postoperative Complications; Patient Outcomes; Secondary Analysis

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Introduction

Liver transplantation is a lifesaving and highly complex surgery that is associated with high rates of postoperative complications.(1) Data on graft- and patient survival for liver transplant recipients are very effectively collected through the United Network for Organ Sharing, and have provided individual transplant centers a benchmark for comparison. In contrast, national data on postoperative complication rates are very incompletely collected by the United Network for Organ Sharing. Hence, data available to transplant centers to accurately inform their patients about the postoperative risks of liver transplantation and perform internal quality control are largely limited to single-center and anecdotal reports.

Beyond providing information to liver transplant recipients, more comprehensive data on postoperative complications after liver transplantation would allow for clinicians and transplant centers to compare their complication rates and appreciate whether investigations and improvements of complication rates are necessary. The mitigation of higher than expected postoperative complication rates can lead to outcome improvement and significant cost-savings, as complications in liver transplant recipients are more costly than in other surgical populations. For example, pneumonia, which adds an estimated cost of \$20,000 for a patient in the general Intensive Care Unit (ICU), adds \$100,000 additional cost in an liver transplant recipient.(2)

In an effort to summarize the presently available data in the literature we have performed a review of the clinical literature over the past 10 years, to identify rates of the most frequently reported biliary, vascular, hemorrhagic and thrombotic, renal, pulmonary, infectious, gastrointestinal, and cardiac complications after liver transplantation.

Materials and Methods

Data Sources

A review of the literature was performed to identify studies that reported the incidence of postoperative complications in deceased donor liver transplant recipients within the first year of surgery. Studies were identified through a search of MEDLINE on October 10, 2012, using the Medical Subject Headings “liver transplantation”, “postoperative complications”, “myocardial infarction”, “pericardial effusion”, “anastomotic leak”, “renal failure”, “respiratory failure”, “pneumothorax”, “pulmonary edema”, “deep venous thrombosis”, “pulmonary embolus”, “pleural effusion”, “postoperative hemorrhage”, “cardiac arrest”, “arrhythmia” and “intestinal obstruction”, which were chosen to reflect the most common post-surgical complications in transplant recipients. A manual search of publication bibliographies was also performed.

Study Selection

IRB approval was received prior to collection of any data. Articles were selected for inclusion if they reported an incidence of postoperative complications in deceased donor liver transplant recipients based on human adult studies over the past decade. Articles were excluded if they were not available in English, were published prior to January 1, 2002, or originated from a location other than the United States, Australia, Canada and Europe.

Articles focusing on complications related to children, living donor liver transplant, multivisceral, and retransplantation were excluded. Analysis of complications related to immunosuppression, post reperfusion syndrome, and malignancy were excluded. Care was taken to exclude initial reports if follow-up reports were available. Decision for inclusion was made by two physician reviewers (LMM, AD). Discordant decisions between reviewers were advanced to full text review. Further disagreement was resolved by reaching consensus through discussion among the three reviewers.

Data Extraction and Quality Assessment

Data from the selected manuscripts were independently extracted from each study by 3 reviewers (LMM, AD, AED). Discordant data were solved by a consensus among the investigators with guidance from a fourth reviewer (DPL). Incidences of the following complications were extracted: biliary (leak, stricture), vascular (hepatic artery thrombosis, hepatic artery stenosis, portal vein thrombosis, portal vein stenosis), hemorrhagic and thrombotic (hemorrhage, deep vein thrombosis, pulmonary embolus), renal (acute renal failure, temporary dialysis, permanent dialysis), pulmonary (respiratory failure, pulmonary edema, pleural effusion, pneumothorax, hospital acquired pneumonia), infectious (intra-abdominal abscess, peritonitis, sepsis, surgical site infections, bacteremia, urinary tract infections, cytomegalovirus, bacteria, viral, fungal, protozoal), gastrointestinal (bowel obstruction, incisional hernia, gastrointestinal bleed), and cardiac complications (myocardial infarction, pericardial effusion, cardiac arrest, arrhythmia).

Data Synthesis and Analysis

For each complication subgroup (biliary, vascular, hemorrhagic/thrombotic, renal, pulmonary, infectious, gastrointestinal and cardiac), single group proportions were summarized using weighted averages of means and standard deviations for each study reporting the complication of interest. Incidence effect estimates were summarized by using the DerSimonian and Laird random-effects model.⁽³⁾ Incidence rates were calculated as percentages. Heterogeneity was assessed using the Cochran Q chi-square test and the I^2 statistic, and was considered significant if $p < 0.10$ or if I^2 was 50% or greater. To explore the potential sources of heterogeneity, we performed additional subset analyses of studies from the United States.

Funnel plots and Egger's regression test were used to assess the potential risk of publication bias. Statistical analyses were performed using SAS 9.3 statistical software (SAS Institute, Cary, NC) and StatsDirect Ltd. (StatsDirect statistical software. <http://www.statsdirect.com>. England: StatsDirect Ltd. 2008).

Results

Search results

A schematic of the search algorithm is shown in Figure 1. Our original search criteria returned 8170 studies, 6253 of which were eliminated based on application of our primary exclusion criteria (language, date, animal studies, pediatric studies, and geography) and title review. Abstract review was performed for 1917 studies, 1783 of which were removed.

After supplemental search results were added, 134 studies were selected for full text review. Overall, our meta-analysis includes 29,227 deceased donor liver transplant recipients from 74 studies performed between 2002 and 2012. Table 1 lists the characteristics of studies included in our final analysis. Of the studies retained, 26 reported on complications in the United States, 44 in Europe, 2 in Australia, and 4 in Canada; six included information on donation after cardiac death. Six had a prospective design.

Pooled proportions of Complications—Table 2 lists the pooled proportions, heterogeneity, and publication bias for complications reported by 4 or more studies. Overall, the incidences of 14 complications were each reported by 5 or more studies. These complications were selected for full quantitative analysis with forest plots shown in Figure 2.

Biliary Complications-leak and stricture—23 studies reported rates of biliary complications.(1, 2, 4-26) 19 studies reported rates of bile leak, and 21 studies reported rates of bile stricture. The estimated mean incidence of biliary leak and stricture for all studies combined was 0.079 (95% CI = 0.055 to 0.107) and 0.125 (95% CI = 0.099 to 0.154) respectively.

Vascular Complications-hepatic artery thrombosis, hepatic artery stenosis, portal vein thrombosis, and portal vein stenosis—15 studies reported rates of vascular complications.(1, 6, 7, 10, 14, 15, 18, 19, 24, 27-34) Hepatic artery thrombosis was reported by 13 studies, with a pooled incidence of 0.045 (95% CI=0.031 to 0.062). Rates of hepatic artery stenosis were reported by 5 studies with a combined incidence of 0.045 (95% CI = 0.015 to 0.089). Rates of portal vein thrombosis were reported by 5 studies, with a combined incidence of 0.042 (95% CI = 0.021 to 0.070). Only 2 studies reported rates of portal vein stenosis, which were not included in our quantitative analysis.

Hemorrhagic and Thrombotic Complications-postoperative hemorrhage, deep venous thrombosis and pulmonary embolus—8 studies reported rates of hemorrhagic and thrombotic complications.(1, 10, 19, 21, 24, 35-38) Of these, 5 studies reported rates of postoperative hemorrhage, with an estimated mean incidence of 0.083 (95% CI = 0.046 to 0.131). Four studies reported rates of pulmonary embolus, with a combined incidence of 0.012 (95% CI = 0.001 to 0.034). A single study reported rates of deep vein thrombosis, which was not included in our quantitative analysis.

Renal complications-acute renal failure, with temporary and with permanent need for hemodialysis—14 studies reported rates of renal complications.(39-53) Thirteen studies reported rates of acute renal failure, with a pooled proportion = 0.299 (95% CI = 0.220 to 0.385). 3 studies reported rates of acute renal failure with a temporary need for dialysis (pooled proportion = 0.195 (95% CI = 0.063, 0.377)). Only three studies reported rates of permanent need for hemodialysis, which were not included in quantitative analysis.

Pulmonary complications-respiratory failure, pulmonary edema, pleural effusion, pneumothorax and pneumonia—12 studies reported rates of pulmonary complications.(1, 35, 38, 41, 50, 54-62) Eight studies reported rates of pneumonia, with a

combined incidence of 0.115 (95% CI = 0.054 to 0.195). Five studies each reported rates of pulmonary edema (Pooled proportion = 0.202 (95% CI = 0.064, 0.391)) and pleural effusion (combined incidence 0.379 (95% CI = 0.092 to 0.724)). Not included in our quantitative analysis were 3 studies that reported rates of pneumothorax and 2 studies that reported rates of respiratory failure.

Infectious complications—intra-abdominal abscess, peritonitis, sepsis, surgical site infection (SSI), bacteremia, urinary tract infection, cytomegalovirus, bacterial, viral, fungal, protozoan—20 studies reported rates of infectious complications.(1, 11, 19, 21, 35, 58, 63-76) Five studies reported rates of intra-abdominal abscess, with a combined incidence 0.044 (95% CI = 0.019 to 0.078). Six studies reported rates of surgical site infection (Pooled proportion of 0.118 (95% CI = 0.054 to 0.202)). Bacteremia rates were reported by 6 studies, with a combined incidence of 0.142 (95% CI = 0.072 to 0.231). Four studies reported rates of viral infections (pooled proportion of 0.128 (95% CI = 0.028 to 0.284)) and fungal infections (pooled proportion of 0.147 (95% CI = 0.119 to 0.176)) without specific organism or system involvement. Peritonitis, sepsis, urinary tract infection, cytomegalovirus, bacterial and protozoan infections were each reported by less than 3 studies.

Gastrointestinal complications: bowel obstruction, incisional hernia, gastrointestinal bleed—Gastrointestinal complications were reported in 6 studies.(1, 71, 77-82) Incisional hernia was reported in 5 studies, with a pooled proportion of 0.084 (95% CI = 0.049 to 0.127). Gastrointestinal bleed and bowel obstruction were reported in an insufficient number of studies for quantitative analysis.

Cardiac complications: Myocardial Infarction, cardiac arrest, pericardial effusion, and arrhythmia—Cardiac complications were reported in 4 studies.(1, 57, 61, 83) Rates of myocardial infarction, cardiac arrest, pericardial effusion and arrhythmia were reported in an insufficient number of studies for quantitative analysis.

Discussion

Liver transplantation is a lifesaving, complex surgery associated with a high rate of complications. Postoperative morbidity is due to a combination of factors related to the patient polymorbidity, graft quality, surgical procedure and postoperative management. Our analysis is the first to report on the pooled incidence rate of the 17 most frequent postoperative complications following deceased donor liver transplant. Our pooled complication rates are lower than those reported previously in the literature, likely demonstrating advancements in both surgical technique and patient care. Pooled complication rates after liver transplantation are very important, as they provide data beyond single center information and transplant clinician perception. They also provide a resource for setting the expectations of providers, patients and families as part of preoperative informed consent process.

Our review allows centers to distinguish between those complications which might be related to surgical technique and which may be reducible through improvements in patient

care. Among the discussed complications, biliary leak and stricture, hepatic artery thrombosis, hepatic artery stenosis, portal vein thrombosis, pleural effusion, intra-abdominal abscess and incisional hernias are commonly believed to be associated with the surgical procedure or surgical technique. Some may be preventable, while others are likely not. In contrast, some of the complications might be mitigated by improvement of the overall care to the liver transplant recipients. For example the 1.2% complication rate of pulmonary embolus, would indicate a significantly higher incidence of deep vein thrombosis, which is known to be reducible with patient care efforts such as diligent placement of sequential compression devices and initiation of heparin once the liver function (e.g., INR) has normalized.(84) Similarly, it is likely that the postoperative pneumonia rate of 15% can be reduced by systematic and intensive pulmonary rehabilitation, such as chest physical therapy, incentive spirometry, early ambulation, short intubation times and other focused interventions, described in general surgery patients.(85) Interestingly the magnitude of the different pooled complication cohorts, seems also reflect the difference in perceived preventability by the transplant community. While biliary complications and infections have large pooled cohorts, pulmonary complications are noticeably smaller. This is most likely due to the fact that biliary complications are deemed preventable, while pleural effusion, for example, is deemed a non-preventable complication directly related to the loss of peritoneal coverage of the diaphragm due to the hepatectomy.

The transplant community has been at the forefront of transparency and quality improvement, and research efforts continue attempts to minimize postoperative morbidity in these incredibly challenging and complex patients. While patient and graft survival are collected rigorously by the United Network for Organ Sharing, there is currently no systematic collection of data on postoperative complications for transplant patients. A national registry of major complications would improve the ability to provide patients with informed consent, serve as a tool for individual center performance monitoring, and provide a central source against which to measure interventions aimed at improving patient care. Successful examples of such registries include the National Heart, Lung, and Blood Institute Percutaneous Transluminal Coronary Angioplasty Registry and the National Heart, Lung, and Blood Institute Dynamic Registry.(86) The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) collects and reports postoperative complication rates for many surgical specialties, but currently not for transplant. As complication rates in transplant recipients cannot easily be compared to other patient populations due to the polymorbid nature of end stage organ disease, adding transplant patients to this national data collection effort would allow for individual center and physician feedback, and is likely to provide information that can lead to outcome improvement. Allowing for comparison of centers to the national mean, if appropriately adjusted, might provide focused incentive to improve outcomes where possible in a field where clinicians are extremely motivated to obtain optimal outcomes for their sick patients. Only reliable, consistently collected data will allow for effectively targeted efforts towards preventing complications. This will require uniformly trained personnel and voluntary participation by centers. The American Society of Transplant Surgeons is presently considering in participating in National Surgical Quality Improvement Program for this reason.

A limitation of this study is the heterogeneity between the studies performed. This may be in part due to variation in sample size. The majority of studies included in our review examined less than 1000 patients, and 6 studies examined between 1000 and 2000 patients. Subgroup analysis of studies performed in the United States was conducted to assess for the relationship of different national systems of quality regulation. We found little difference in the results to account for this variability. We also performed subgroup analysis of DCD donors, but again, found no significant difference in rates. In the end, rather than search for an absolute value of these complications, perhaps we should accept that the range is wide and influenced by not only systems level factors but also hospital level factors. This too is a reason to prospectively collect center specific data on postoperative complications after liver transplantation.

In summary, this is the first systematic review of the incidence of the major postoperative complications after liver transplantation, providing an important reference for health care providers and patients. Prospective national collection of complications in form of a registry may offer opportunities to improve outcomes for these very sick patients undergoing a highly complex, but lifesaving operation.

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Figure 1. Literature search and exclusion schematic

Biliary

Vascular**Hepatic Artery Thrombosis (N=6758)** **Hepatic Artery Stenosis (N=971)**

Hemorrhagic/thrombotic **Pulmonary**

Infectious

Renal **Gastrointestinal** **Figure 2. Forest Plots of Quantitatively Analyzed Studies**

Table 1
Included Studies

Study	Reference	Subgroup	Nation	Study Type	Outcomes	N
1	Abt, 2003	DBD DCD	US	Retrospective	Biliary leak, stricture	221 15
2	Aduen, 2003		US	Retrospective	Pulmonary Edema	91
3	Aduen, 2005		US	Retrospective	Pneumonia	401
4	Alsharabi, 2006		Poland	Retrospective	Biliary leak, stricture	100
5	Alsharabi, 2007		Poland	Retrospective	Biliary leak, stricture	200
6	Amador, 2005		Spain	Retrospective	Biliary leak, stricture; bacterial, viral, fungal, protozoal infections	300
7	Baccarani, 2010		Italy	Retrospective	Biliary leak, stricture	117
8	Benson, 2011		US	Retrospective	SSI, PNA, UTI, Bacteremia	514
9	Biagioni, 2011		Italy	Retrospective	Acute Renal Failure	84
10	Bozbas, 2008		Turkey	Retrospective	Pleural Effusion	130
11	Cabezuelo, 2002		Spain	Retrospective	Acute Renal Failure	162
12	Cabezuelo, 2006		Spain	Retrospective	Acute Renal Failure	184
13	Cherian, 2010		UK	Retrospective	Pulmonary Embolus	214 9
14	Dorobantu, 2010		Italy	Retrospective	Biliary leak, stricture	487
15	Faenza, 2007		Italy	Retrospective	Acute Renal Failure	512
16	Foley, 2005	DBD DCD	US	Retrospective	Biliary stricture, HAT, HAS, PVT, PVS	553 36
17	Fouad, 2009	>40yo	Canada	Retrospective	Pulmonary edema, MI, arrhythmia	197
18	Freise, 2008		US	Retrospective	Biliary leak, stricture, HAT, PVT, hemorrhage, DVT, PE, pulmonary edema, pleural effusion, pneumothorax, pneumonia, abscess, bacteremia, UTI, bacterial, viral, fungal infections, bowel obstruction, incisional hernia, GI bleed, MI, cardiac arrest	216
19	Fujita, 2007	DBD DCD	US	Retrospective	Biliary leak, stricture, HAT	120 9 24
20	Gainza, 2002		Spain	Retrospective	Acute Renal Failure	251
21	GarciaPrado, 2008		Spain	Prospective	SSI	167
22	Grodzicki, 2011		Poland	Retrospective	HAT	862
23	Guitard, 2006		France	Retrospective	Acute Renal Failure	94
24	Hellinger, 2009		US	Prospective	SSI	370
25	Hellinger, 2011		US	Retrospective	SSI	103 6
26	Hernandez, 2010	DCD	Canada	Retrospective	HAT, HAS, Biliary stricture	10
27	Herrero, 2007		Spain	Retrospective	Gastrointestinal bleed	417

Study	Reference	Subgroup	Nation	Study Type	Outcomes	N
28	Ishigami, 2004		US	Prospective	HAT, HAS	84
29	Junge, 2006		Germany	Retrospective	Acute Renal Failure	1352
30	Kappa, 2010		US	Retrospective	Hemorrhage	410
31	Kahn, 2007		Austria	Retrospective	Incisional Hernia	90
32	Karvellas, 2011		Canada	Retrospective	Bacteremia	218
33	Krol, 2011		Poland	Retrospective	Biliary leak, stricture, HAT	84
34	Kundakci, 2010		Turkey	Retrospective	Acute Renal Failure	112
35	Leithead, 2012	DBD DCD	UK	Retrospective	Acute Renal Failure	88 88
35	Levesque, 2012		France	Retrospective	Respiratory failure, pulmonary edema, pleural effusion, pulmonary embolus, pneumothorax, pneumonia	212
36	Linares, 2009		Spain	Retrospective	Bacterial Infections	340
37	Maluf, 2005		US	Retrospective	Biliary leak, stricture	202
38	Mark, 2005		Austria	Retrospective	Sepsis, PNA, viral infections	360
39	Mathur, 2011		US	Retrospective	Biliary leak, stricture	409
40	Nadim, 2012		US	Retrospective	Acute Renal Failure	351
41	Nyckowski, 2002		Poland	Retrospective	Biliary stricture, HAT, PVS	71
42	Oldakowska, 2003		Poland	Retrospective	CMV	123
43	Pacholczyk, 2006		Poland	Retrospective	Biliary leak, stricture	101
44	Pacholczyk, 2011		Poland	Retrospective	Fungal Infections	175
45	Pakosz-Golanowska, 2010		Poland	Retrospective	HAT, HAS	210
46	Paramesh, 2004		US	Retrospective	Acute Renal Failure	1602
47	Patkowski, 2003		Poland	Retrospective	Biliary leak, stricture	193
48	Pawarode, 2003		US	Retrospective	Acute Renal Failure	154
49	Pawlak, 2003		Poland	Retrospective	Biliary leak, Hemorrhage, HAT	193
50	Pellegrino, 2008		Italy	Retrospective	Pneumonia	71
51	Piazzese, 2004		Italy	Retrospective	Incisional Hernia	623
52	Pine, 2009	DBD DCD	UK	Retrospective	Biliary leak, stricture, HAT, HAS, Hemorrhage, Abscess	39 39
53	Pirat, 2004		Turkey	Retrospective	Respiratory failure, pulmonary edema, pleural effusion, pneumothorax, pneumonia	44
54	Piselli, 2007		Italy	Prospective	Bacteremia, viral and fungal infections	103
55	Punpapong, 2006		US	Retrospective	Peritonitis	837
56	Rerknimitr, 2002		US	Retrospective	Biliary leak, stricture	367
57	Safadi, 2009		US	Retrospective	MI	403
58	Sakai, 2012		US	Retrospective	Pulmonary Embolus	495

Study	Reference	Subgroup	Nation	Study Type	Outcomes	N
59	Schaeffer, 2009	Obese	Canada	Retrospective	SSI, Incisional hernia	167
60	Sharma, 2010		US	Retrospective	PVT	117 1
61	Shi, 2003		Australia	Retrospective	Incisional Hernia	410
62	Stange, 2003		Germany	Retrospective	HAT	119 2
63	Suarez, 2010		Spain	Retrospective	PVT	617
64	Sundaram, 2011		US	Retrospective	Biliary leak, stricture, HAT	179 8
65	Tachopoulou, 2003		US	Retrospective	Abscess	459
66	Tarantino, 2008		Italy	Prospective	Biliary leak, stricture	193
67	Tenza, 2009		Spain	Retrospective	Pleural Effusion, Acute Renal Failure	74
68	Tinti, 2011		Italy	Retrospective	Acute Renal Failure	44
69	Torre, 2002		Spain	Retrospective	Bacteremia	405
70	Urbani, 2003		Italy	Retrospective	Biliary leak, stricture, hemorrhage	398
71	Varo, 2002		Spain	Retrospective	CMV	186
72	Verran, 2003		Australia	Retrospective	HAT	415
73	Weiss, 2010		France	Prospective	Pneumonia	148
74	Welling, 2008		US	Retrospective	Biliary leak, stricture	213

CMV: Cytomegalovirus; DBD: Donation after brain death; DCD: Donation after cardiac death; DVT: Deep Vein Thrombosis; GI: Gastrointestinal; HAS: Hepatic Artery Stenosis; HAT: Hepatic Artery Thrombosis; MI: Myocardial Infarction; PE: Pulmonary Embolus; PNA: Pneumonia; PVT: Portal Vein Thrombosis; PVS: Portal Vein Stenosis; SSI: Surgical Site Infection; UK: United Kingdom; US: United States

Table 2
Pooled complication incidences, heterogeneity, and bias

Complication	N	Pooled proportion	95% CI	P-Value	I ²	Egger's Bias
Biliary						
Biliary Leak	6882	0.079	0.055 to 0.107	<0.001	93.0	2.84, p=0.067
Biliary Stricture	7387	0.125	0.099 to 0.154	<0.001	91.2	2.69, p=0.020
Vascular						
Hepatic Artery Thrombosis	6758	0.045	0.031 to 0.062	<0.001	85.0	0.56, p=0.584
Hepatic Artery Stenosis	971	0.045	0.015 to 0.089	<0.001	80.1	1.27, p=0.331
Hemorrhagic/Thrombotic						
Portal Vein Thrombosis	2593	0.042	0.021 to 0.070	<0.001	91.3	3.43, p=0.242
Hemorrhage	1295	0.083	0.046 to 0.131	<0.001	84.9	2.24, p=0.327
Pulmonary Embolus	2860	0.012	0.001 to 0.034	<0.001	91.4	2.03, p=0.364
Renal						
Acute Renal Failure	4998	0.299	0.220 to 0.385	<0.001	97.2	6.24, p=0.006
Pulmonary						
Pulmonary Edema	457	0.202	0.064 to 0.391	<0.001	97.0	8.84, p=0.077
Pleural Effusion	334	0.379	0.092 to 0.724	<0.001	98.8	-16.02, p=0.344
Pneumonia	1966	0.155	0.054 to 0.195	<0.001	95.7	5.84, p<0.001
Infectious						
Intra-Abdominal Abscess	1281	0.044	0.019 to 0.078	<0.001	86.4	1.86, p=0.297
Surgical Site Infection	537	0.118	0.054 to 0.202	<0.001	96.9	9.33, p=0.117
Bacteremia	1796	0.142	0.072 to 0.231	<0.001	95.8	8.23, p=0.020
Viral	979	0.128	0.028 to 0.284	<0.001	97.3	8.42, p=0.043
Fungal	794	0.147	0.119 to 0.176	0.278	22.2	1.29, p=0.734
Gastrointestinal						
Incisional Hernia	1506	0.084	0.049 to 0.127	<0.001	85.0	3.74, p=0.046