

Appendix Table 2. Study Characteristics of Multivariate Studies of Clinical Predictors*

Author, Year (Reference)	Study Type	Timeline	Type of Surgery	Specific PPCs Studied	Inclusion Criteria
Garibaldi et al., 1981 (100)	Cohort	Prospective	Thoracic and abdominal	Pneumonia	
Windsor and Hill, 1988 (101)	Cohort	Prospective	Elective gastrointestinal resection	Pneumonia, atelectasis	
Gerson et al., 1990 (102)	Cohort	Prospective	Abdominal and noncardiac thoracic	Pneumonia, noncardiogenic pulmonary edema, pulmonary embolus	Age > 65 y
Pedersen et al., 1990 (103)	Cohort	Prospective	All	Intubated > 24 h	
Svensson et al., 1991 (104)	Cohort	Prospective	Thoracoabdominal aortic	Respiratory failure	
Williams-Russo et al., 1992 (105)	Cohort	Prospective	Noncardiac	Pneumonia, atelectasis	Diabetes or hypertension
Oller Sales et al., 1992 (106)	Cohort	Prospective	Abdominal	Pneumonia	
Pedersen et al., 1992 (107)	Cohort	Prospective	Noncardiac	Respiratory failure, atelectasis, pneumonia	
Wong et al., 1995 (108)	Cohort	Prospective	Noncardiothoracic	Pneumonia, respiratory failure, bronchospasm	COPD, FEV ₁ < 1.2 L, FEV ₁ :FVC < 75%
Fujita and Sakurai, 1995 (109)	Cohort	Retrospective	Abdominal	Atelectasis, pneumonia	
Lawrence et al., 1996 (110)	Case-control	Retrospective	Elective abdominal	Pneumonia, respiratory failure, bronchospasm, bronchitis, pleural effusion	
Hall et al., 1996 (111)	Cohort	Prospective	Abdominal	Pneumonia, respiratory failure	
Barisione et al., 1997 (112)	Cohort	Prospective	Abdominal	Pneumonia, atelectasis, respiratory failure	
Brooks-Brunn, 1997 (113)	Cohort	Retrospective	Abdominal	Pneumonia, atelectasis	
Bluman et al., 1998 (114)	Cohort	Prospective	Elective	Pneumonia, bronchospasm, reintubation, pulmonary death	General or spinal anesthesia
Mitchell et al., 1998 (115)	Cohort	Prospective	Elective nonthoracic	Bronchitis, bronchospasm, atelectasis, pneumonia, ARDS, pleural effusion, pneumothorax, respiratory failure	
Pereira et al., 1999 (116)	Cohort	Prospective	Abdominal	Pneumonia, bronchitis, atelectasis, respiratory failure, bronchospasm	
Liu and Leung, 2000 (117)	Cohort	Retrospective	Noncardiac	Respiratory failure, pneumonia, ARDS	Age ≥ 80 y
Arozullah et al., 2000 (118)	Cohort	Prospective	Noncardiac	Respiratory failure	General, spinal, or epidural anesthesia
Møller et al., 2001 (119)	Cohort	Prospective	Abdominal, urologic, or orthopedic	Pneumonia, atelectasis, pneumothorax, respiratory failure	
Arozullah et al., 2001 (120)	Cohort	Prospective	Noncardiac	Pneumonia	General, spinal, or epidural anesthesia
Leung and Dzankic, 2001 (121)	Cohort without comparison	Prospective	Mixed	Pulmonary edema, reintubation, pulmonary consolidation on chest radiograph, pneumothorax, pleural effusion	Consecutive patients age ≥70 y, noncardiac elective (86%), emergency (14%), general (24%), orthopedic (18%), neurosurgical (13%), urologic (13%), head and neck (9%), gynecologic (9%), vascular (8%), thoracic (5%), cosmetic (1%)
Canturk et al., 2002 (122)	Cohort	Prospective	General	Pneumonia	
O'Brien et al., 2002 (123)	Cohort	Prospective	Noncardiac	Respiratory failure, pneumonia	General, spinal, or epidural anesthesia

Appendix Table 2—Continued

Exclusion Criteria	Hierarchy of Research Design†	Study Quality	Considered All Key Confounders: Type of Surgery, Age, COPD	Patients, n	PPCs, n	Mean Age, y	Men, %
	II-2	Poor	Yes	520	91		38
Sepsis, immunocompromised, or preoperative intravenous nutrition essential	II-3/C	Fair	Yes	80	Pneumonia, 11; atelectasis, 36		
	II-2	Poor	No	177	24	73	49
	II-2/B-C	Fair	Yes	7306	348		36
	II-2	Fair	Yes	98	59	63.5	61
	II-2	Fair	Yes	278	16		39
Thoracoabdominal incision, splenectomy	II-2/B-C	Fair	Yes	2083	269		21
Regional anesthesia, incomplete database	II-2	Fair	Yes	7029	290		
Preexisting tracheostomy, thoracic surgery	II-2	Fair	Yes	105	39	68	96
	II-3	Poor	No	2969	89		
Atelectasis as sole pulmonary complication	II-2	Good	Yes	164	NA	65	
Hernia repair, age < 14 y, preexisting pulmonary complication	II-2	Good	Yes	1322	199	56	48
None	II-3	Fair	Yes	361	49	64	69
Age < 18 y, laparoscopy, postoperative mechanical ventilation, preoperative pneumonia or atelectasis	II-2	Good	Yes	400	90	52.5	35
Otolaryngology surgery, neurosurgery, pipe or cigar smokers	II-2	Fair	Yes	410	59	59	97
Regional anesthesia	II-2	Fair	Unclear	148	16	61.2	
	II-1	Fair	Yes	408	92	55	50
Ambulatory surgery	II-2	Poor	No	367	27	84.4	38
Organ transplantation, female patients, ventilator-dependent, DNR	II-2	Good	Yes	81 719	2746		
Age < 15 y	II-2	Poor	No	4725	204		47
Low-risk surgery, organ transplantation	II-2	Good	Yes	160 805	2466	62	95
	II-2/C	Poor	No	544	30		44
Hospital stay < 1 d	II-2	Poor	Yes	418	23		43
Low-risk surgery, organ transplantation	II-2	Fair	Partially (emergent vs. elective surgery)	49 091	3805	61.6	97

Appendix Table 2—Continued

Author, Year (Reference)	Study Type	Timeline	Type of Surgery	Specific PPCs Studied	Inclusion Criteria
Ferguson and Durkin, 2002 (124)	Cohort	Retrospective	Esophagectomy	Pneumonia, respiratory failure	
Elkhouri et al., 2004 (125)	Cohort	Retrospective	Aortic aneurysm	Pneumonia, respiratory insufficiency, pulmonary embolus	Infrarenal degenerative AAA
McAllister et al., 2005 (126)	Cohort without comparison	Prospective	Nonthoracic	Respiratory failure, pneumonia, atelectasis, pneumothorax or pleural effusion requiring intervention	Elective nonthoracic

* AAA = abdominal aortic aneurysm; ARDS = acute respiratory distress syndrome; COPD = chronic obstructive pulmonary disease; DNR = do not resuscitate; ICU = intensive care unit; NA = not available; PPC = postoperative pulmonary complication.

† Based on criteria from the U.S. Preventive Services Task Force (12).

Appendix Table 2—Continued

Exclusion Criteria	Hierarchy of Research Design†	Study Quality	Considered All Key Confounders: Type of Surgery, Age, COPD	Patients, <i>n</i>	PPCs, <i>n</i>	Mean Age, <i>y</i>	Men, %
	II-B/C	Poor	No	292	78	60	79
	II-2	Poor	Yes	355	45	73	88
Hospitalized, mechanically ventilated, planned ICU admission, sleep apnea, neuromuscular disease, medical problems that precluded participation	II-2	Good	Yes	1055	28	55	50