

**Appendix Table 3. Significant Clinical Predictors in Multivariate Studies\***

Author, Year (Reference)	RR (95% CI)	P Value
<b>Arozullah et al., 2001 (120)</b>		
Significant factors		
AAA repair	4.29 (3.34–5.50)	
Thoracic	3.92 (3.36–4.57)	
Upper abdominal	2.68 (2.38–3.03)	
Neck	2.3 (1.73–3.05)	
Neurosurgery	2.14 (1.66–2.75)	
Vascular	1.29 (1.10–1.52)	
Age ≥ 80 y	5.63 (4.62–6.84)	
Age 70–79 y	3.58 (2.97–4.33)	
Age 60–69 y	2.38 (1.98–2.87)	
Age 50–59 y	1.49 (1.23–1.81)	
Totally dependent	2.83 (2.33–3.43)	
Partially dependent	1.83 (1.63–2.06)	
Weight loss > 10% in 6 mo	1.92 (1.68–2.18)	
COPD	1.72 (1.55–1.91)	
General anesthesia	1.56 (1.36–1.80)	
Impaired sensorium	1.51 (1.26–1.82)	
History of CVA	1.47 (1.28–1.68)	
BUN level < 8 mg/dL	1.47 (1.26–1.72)	
BUN level, 22–30 mg/dL	1.24 (1.11–1.39)	
BUN level ≥ 30 mg/dL	1.41 (1.22–1.64)	
Transfusion > 4 units	1.35 (1.07–1.72)	
Emergency surgery	1.33 (1.16–1.54)	
Steroid use	1.33 (1.12–1.58)	
Current smoker within 1 y	1.28 (1.17–1.42)	
Alcohol > 2 drinks per day in past 2 wk	1.24 (1.08–1.42)	
<b>Leung and Dzankic, 2001 (121)</b>		
Significant factors		
Emergency surgery	3.6 (1.6–8.3)	0.003
History of CHF	5.7 (2.1–16)	0.001
Invasive monitoring	9.7 (3.7–25.4)	<0.001
<b>Møller et al., 2001 (119)</b>		
Significant factors		
Age > 65 y	1.63 (1.45–1.84)	
COPD	4.21 (2.77–6.41)	
<b>Arozullah et al., 2000 (118)</b>		
Significant factors		
Albumin level < 20 g/L	4.33 (3.99–5.52)	
Albumin level, 20–30 g/L	2.16 (1.86–2.51)	
Albumin level, 31–40 g/L	1.17 (1.05–1.31)	
Age ≥ 70 y	2.60 (2.21–3.05)	
Age 60–69 y	1.99 (1.70–2.33)	
Age 50–59 y	1.50 (1.25–1.79)	
Totally dependent	2.24 (1.88–2.66)	
Partially dependent	1.50 (1.25–1.79)	
Weight loss > 10% in 6 mo	1.37 (1.19–1.57)	
Alcohol > 2 drinks per day	1.19 (1.07–1.33)	
Diabetes	1.15 (1.00–1.33)	
BUN level > 40 mg/dL	2.35 (2.00–2.76)	
BUN level, 31–40 mg/dL	2.09 (1.78–2.45)	
BUN level, 21–30 mg/dL	1.31 (1.18–1.46)	
Preoperative renal failure	1.67 (1.23–2.27)	
Transfusion > 4 units	1.56 (1.28–1.91)	
Preoperative pneumonia	1.70 (1.35–2.13)	
Dyspnea at rest	1.69 (1.36–2.09)	
Dyspnea on minimal exertion	1.21 (1.09–1.34)	
COPD	1.58 (1.44–1.75)	
Recent smoking	1.24 (1.14–1.36)	
CHF	1.25 (1.07–1.47)	
Impaired sensorium	1.22 (1.04–1.43)	
CVA	1.20 (1.05–1.38)	

**Appendix Table 3—Continued**

Author, Year (Reference)	RR (95% CI)	P Value
<b>AAA surgery</b>		
AAA surgery	11.00 (9.20–13.10)	
<b>Thoracic surgery</b>		
Thoracic surgery	5.91 (5.15–6.78)	
<b>Peripheral vascular surgery</b>		
Peripheral vascular surgery	3.40 (2.96–3.91)	
<b>Upper abdomen surgery</b>		
Upper abdomen surgery	3.36 (2.96–3.80)	
<b>Neurosurgery</b>		
Neurosurgery	2.96 (2.35–3.73)	
<b>Neck surgery</b>		
Neck surgery	2.13 (1.63–2.77)	
<b>Emergency surgery</b>		
Emergency surgery	2.81 (2.54–3.11)	
<b>General anesthesia</b>		
General anesthesia	1.91 (1.64–2.21)	
<b>Liu and Leung, 2000 (117)</b>		
Significant factors		
CHF	4.3 (2.3–6.9)	
Neurologic disease	3.4 (1.4–8.0)	
Arrhythmia	2.9 (1.1–7.5)	
Intraoperative vasopressor use	12.4 (2.5–63.0)	
Emergent surgery	3.0 (1.2–7.6)	
<b>Pereira et al., 1999 (116)</b>		
Significant factors		
COPD	2.24 (1.66–2.97)	
Surgery > 210 min	1.58 (1.15–2.18)	
Comorbid condition (hypertension, diabetes, or heart disease)	1.48 (1.10–1.97)	
<b>Bluman et al., 1998 (114)</b>		
Significant factors		
Current smoker	4.2 (1.2–14.8)	
General anesthesia	5.7 (2.5–12.6)	
Abnormal chest radiograph	6.3 (2.6–15.2)	
COPD	3.8 (1.8–7.8)	
High school graduate	2.0 (1.0–4.0)	
<b>Barisione et al., 1997 (112)</b>		
Significant factors		
Chronic bronchitis	133 (14.8–1199)	<0.001
FEV <sub>1</sub> (% predicted)	0.93 (0.88–0.98)	<0.01
RV (L)	3.11 (1.25–7.75)	0.01
DLco (% predicted)	0.91 (0.10–8.16)	<0.001
<b>Brooks-Brunn, 1997 (113)</b>		
Significant factors		
Age ≥ 60 y	1.89 (1.02–3.24)	
BMI ≥ 27 kg/m <sup>2</sup>	2.82 (1.66–4.78)	
Impaired cognition	5.93 (0.92–38.19)	
History of cancer	2.23 (1.30–3.81)	
Cigarette use in past 8 wk	2.27 (1.23–4.21)	
Upper abdominal incision	2.30 (1.33–4.01)	
<b>Hall et al., 1996 (111)</b>		
Significant factors		
ASA class III–IV	NA	
Chronic bronchitis	NA	
Preoperative stay > 5 d	NA	
Current smoker	NA	
<b>Lawrence et al., 1996 (110)</b>		
Significant factors		
Abnormal chest examination	5.8 (1.04–32.1)	
Abnormal chest radiograph	3.2 (1.07–9.4)	
Goldman cardiac risk index, per point	2.01 (1.17–3.6)	
Charlson comorbidity index, per point	1.6 (1.004–2.6)	

Appendix Table 3—Continued

Author, Year (Reference)	RR (95% CI)	P Value
<b>Fujita and Sakurai, 1995 (109)</b>		
Significant factors		
Age > 65 y	NA	
Blood loss > 1.2 L	NA	
Preoperative inhalational therapy	NA	
<b>Pedersen et al., 1992 (107)</b>		
Significant factors		
Age ≥ 70 y	7.24 (3.72–14.10)	
Age 50–69 y	4.01 (2.14–7.52)	
Age 30–49 y	2.23 (1.14–4.33)	
COPD	3.06 (1.88–5.00)	
Pancuronium use	3.00 (2.07–4.36)	
Atracurium use	1.35 (0.78–2.34)	
Surgery > 3 h	3.22 (2.31–4.50)	
Abdominal surgery	3.63 (2.41–5.48)	
Major orthopedic surgery	4.27 (0.71–2.29)	
Emergency surgery	3.39 (2.48–4.63)	
<b>Williams-Russo et al., 1992 (105)</b>		
Significant factors		
AAA repair	NA	
COPD	NA	
<b>Oller Sales et al., 1992 (106)</b>		
Significant factors		
Duration of anesthesia	"Associated"	
ASA class	"Associated"	
Gastric surgery	"As were"	
Intestinal surgery	"Lesser extent"	
Age	"Weak"	
<b>Svensson et al., 1991 (104)</b>		
Significant factors		
COPD	4.86	0.0084
Cigarette use	10.3	0.0084
Cardiac complication	19.1	0.0091
Renal complication	21.3	0.004
<b>Gerson et al., 1990 (102)</b>		
Significant factor		
Poor exercise capacity	7.1 (5.10–9.89)	
<b>Windsor and Hill, 1998 (101)</b>		
Significant factors		
Upper vs. lower abdominal incision	9.68 (1.53–61.09)	0.015
Protein depletion	278.66 (0.14–570575.06)	0.14
Age	1.03 (0.97–1.09)	0.34
Duration of surgery	1.34 (0.66–2.71)	0.42
Obesity	2.75 (0.11–69.69)	0.54
Smoking	1.48 (0.28–7.81)	0.64
<b>Garibaldi et al., 1981 (100)</b>		
Significant factors		
Longer duration of surgery	NA	
Upper abdominal surgery	NA	
Abnormal serum albumin level	NA	
History of cigarette smoking	NA	
<b>Mitchell et al., 1998 (115)</b>		
Significant factors		
Postoperative nasogastric tube	21.8	
Preoperative sputum production	4.6	
Anesthesia time	No data	

Appendix Table 3—Continued

Author, Year (Reference)	RR (95% CI)	P Value
<b>Pedersen et al., 1990 (103)</b>		
Significant factors		
Age 50–69 y	4.26 (2.37–7.68)	<0.001
Age ≥ 70 y	5.70 (3.04–10.67)	<0.001
COPD	2.92 (1.86–4.58)	<0.001
Major operation	4.85 (3.35–7.05)	<0.001
Emergency operation	2.51 (1.87–3.37)	<0.001
General anesthesia with muscle relaxant	2.83 (1.99–4.03)	<0.001
<b>Ferguson and Durkin, 2002 (124)</b>		
Significant factors		
Age per 10-y increment	1.31 (0.99–1.74)	0.059
FEV <sub>1</sub> per 10% decrement	1.21 (1.07–1.38)	0.003
Thoracotomy and laparotomy	2.49 (1.30–4.76)	0.006
<b>O'Brien et al., 2002 (123)</b>		
Significant factors		
Creatinine level, 1.5–2.0 mg/dL	1.42 (1.22–1.64)	
Creatinine level, 2.0–2.5 mg/dL	1.39 (1.11–1.75)	
Creatinine level, 2.5–3.0 mg/dL	1.60 (1.23–2.07)	
Creatinine level > 3.0 mg/dL	1.58 (1.31–1.89)	
<b>Canturk et al., 2002 (122)</b>		
Significant factors		
Surgery > 1 h duration	1.06 (1.05–1.13)	0.034
HDL cholesterol level ≤ 35 mg/dL	1.16 (1.05–1.29)	0.05
COPD	2.5 (1.1–5.5)	0.04
<b>Wong et al., 1995 (108)</b>		
Significant factors		
Abdominal incision	18 (1.2–97.1)	0.0001
Anesthesia duration (per hour)	1.78 (1.14–2.71)	0.0001
ASA physical status 4 or 5	41 (5.8–292.4)	0.0002
General anesthesia	20 (3.1–127.0)	0.0008
FEV <sub>1</sub> :FVC ≤ 0.5	16 (2.7–88.4)	0.0020
Shapiro score ≥ 5	10 (1.1–89.4)	0.0345
<b>Elkhouri et al., 2004 (125)</b>		
Significant factors		
Endovascular aortic repair (compared with open surgery)	0.14 (0.04–0.47)	0.002
<b>McAllister et al., 2005 (126)</b>		
Significant factors		
Age ≥ 65 y	5.9	<0.001
Positive cough test result	3.8	0.01
Perioperative nasogastric tube	7.7	<0.001
Duration ≥ 2.5 h	3.3	0.008

\* To convert BUN values to mmol/L, multiply by 0.357. To convert creatinine values to μmol/L, multiply by 88.4. To convert HDL cholesterol values to mmol/L, multiply by 0.02586. AAA = abdominal aortic aneurysm; ASA = American Society of Anesthesiologists; BMI = body mass index; BUN = blood urea nitrogen; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; CVA = cerebrovascular accident; DLCO = diffusing capacity of carbon monoxide; HDL = high-density lipoprotein; NA = not available; RR = relative risk; RV = residual volume.