Tempistica della tracheotomia: facciamo chiarezza

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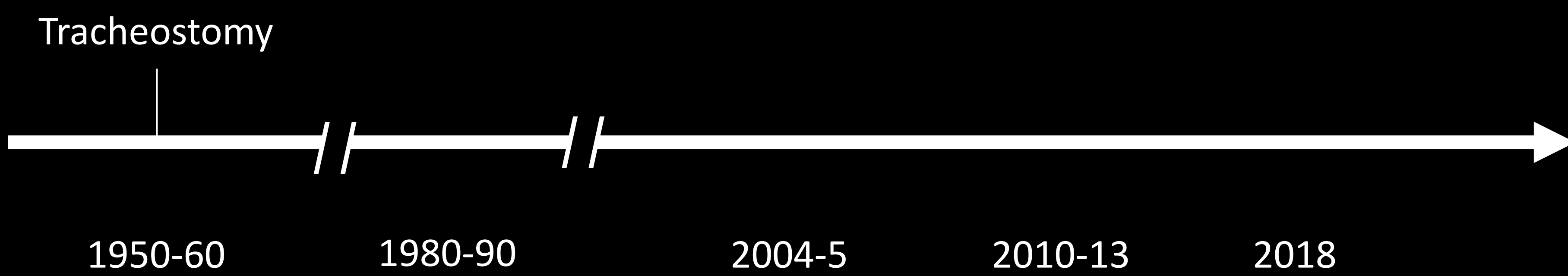

Tracheostomy
1950-60
1980-90
2004-5
2010-13
2018

number of patients rendered liable to them. Nevertheless, in three years of routine ear, nose and throat practice, we have seen twelve cases. Some have suffered severe disability, whilst others have been symptomless, and of interest only to the observer.

Our cases correspond closely to those reported elsewhere (see additional references), and we believe that a brief clinical description may be of interest to general surgeons and anæsthetists, as well as to laryngologists.

THE LESIONS

The following summary is based on cases which have

Young, British Journal of Anesthesia (1951);25:32

Angiomatous polyp					1					1

TABLE 3. *Relation of Changes to Major Diagnoses*

Diagnoses	Neg.	+	++	+++	Total	Neg.	+	++	+++	Total
Advanced malignancies					19					8
without bronchopneumonia	4	3	3	0	10	5	0	0	0	5
with bronchopneumonia	2	3	4	0	9	1	0	2	0	3
Cardiovascular disease					7					9
without bronchopneumonia	1	0	2	3	6	3	2	0	1	6
with bronchopneumonia	0	0	1	0	1	2	1	0	0	3
Trauma					1					4
without bronchopneumonia	0	0	1	0	1	0	1	0	0	1
with bronchopneumonia	0	0	0	0	0	0	0	3	0	3
Blood dyscrasia					1					2
without bronchopneumonia	0	0	0	1	1	1	0	0	0	1
with bronchopneumonia	0	0	0	0	0	0	1	0	0	1

Stein, Ann Surg (1960):130

tion and the indications for its use. This controversy cannot as yet be resolved on the basis of general principles.

After 1955 (Bjørneboe *et al.*) the treatment of this disease at the Blegdamshospitalet has been centralized in the Department of Epidemiology where IPPV had been extensively used during the poliomyelitis epidemics in 1952–53 (Lassen, 1956); the principles of prolonged artificial ventilation evolved during that period were applied.

Clinical material

Survival rates for patients treated by tracheostomy and artificial ventilation for respiratory insufficiency in chronic diffuse lung disease

Time	Total (%)	Respiratory reserve before acute exacerbation		
		Group A (%)	Group B (%)	Group C (%)
Respirator	88(136)	96(56)	81(59)	81(21)
Discharge	75(136)	86(56)	71(59)	57(21)
3 months	65(136)	73(56)	66(59)	38(21)
6 months	54(136)	70(56)	53(59)	19(21)

Survey of patients

Year	Group	Age (yr)	Sex	Dura resp treat (d
1955	B	63	M	
1956	B	66	M	
1958	C	62	M	
1959	B	67	M	
1959	C	47	M	

Kristensen, Poatgrad Med J (1967);43:244

TABLE 1. Incidence (%) of complications associated with tracheostomy

Reference (yr)	No. of Patients	Displaced Tubes	Bleeding	Obstruction	Subcutaneous Emphysema	Pneumothorax	Aspiration	Perioperative Morbidity
Meade, 1961 (11)	212	3	3	2	1	1	[a]	10
Glas, 1962 (12)	80	2	9	5	0	2	[a]	18
Dugan, 1963 (13)	461	0.4	3	2	2	1	[a]	9
Yarington, 1965 (14)	240	2	1	0.4	1	1	[a]	6
Rogers, 1969 (3)	688	2	1	2	0.1	0.1	1	7
Skaggs, 1969 (2)	147	5	40[b]	2	1	1	2	51
Chew, 1972 (1)	100	7	1	2	0	1	0	11
Dane, 1975 (7)	40	[a]	5[b]	2.5	[a]	5	[a]	51
Stauffer, 1981 (6)	51	[a]	36[b]	4	9	4	8	20
Stock, 1986	81	0	2.4	0	0	2.4	0	6

[a] Incidence not specifically noted in text.
[b] Includes patients with bleeding disorders.

In our experience a tracheostomy may allow for earlier discharge from ICU without increased hospital lenght of stay

Stock, Critical Care Medicine (1986);87(6):715

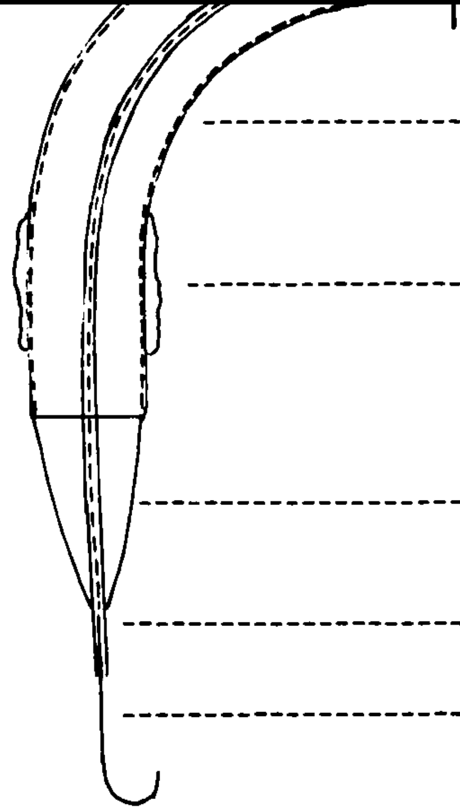
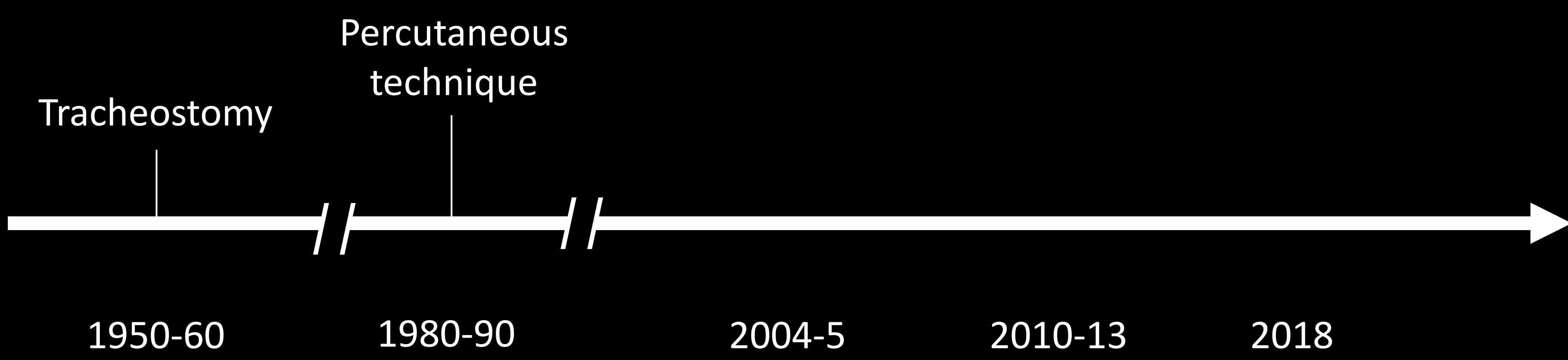


FIGURE 1. Percutaneous tracheostomy assembly. Outer diameter of dilator should be slightly less than the inner diameter of the tracheostomy tube if single. If an inner cannula is used, this is removed and the dilator should fit inside the *outer* tube snugly.

cartilages without cutting them and fits snugly into the stoma and wound. As we began using smaller tubes, our incision became smaller, with a skin incision long enough to admit only the fingertip for better palpation of the cricoid cartilage.

Ciaglia, Chest (1985);87(6):715


Percutaneous
technique
Tracheostomy
1950-60
1980-90
2004-5
2010-13
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Perceived benefits

improved patient comfort
reduced sedative drug use,
faster weaning from mechanical ventilation
reduced incidence of nosocomial pneumonia,
shorter hospitalization

Complications

Is earlier better?

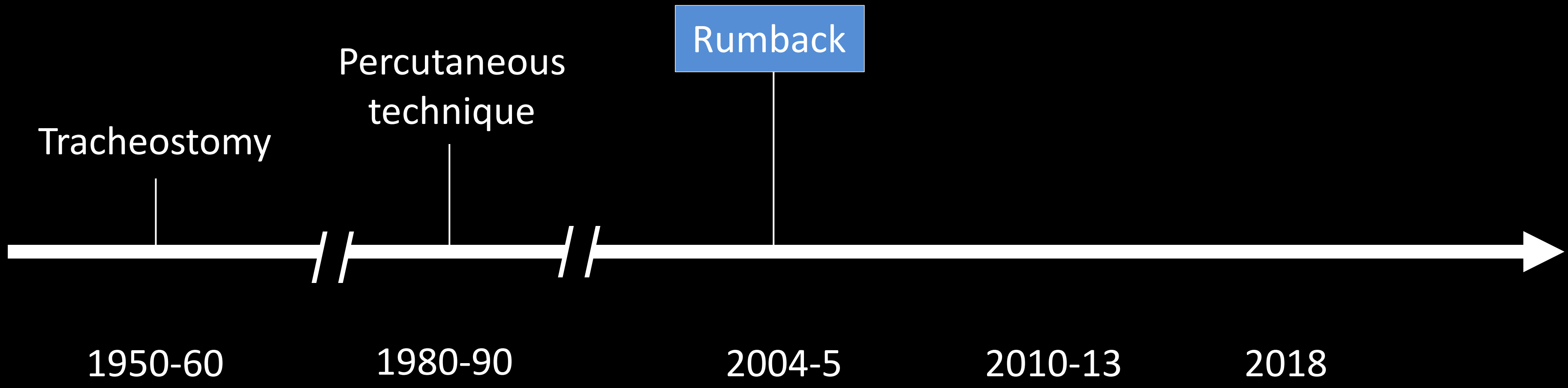

Rumback
Percutaneous
technique
Tracheostomy
1950-60
1980-90
2004-5
2010-13
2018

Table 2. Outcome measures

Outcome Measurement	Early Tracheotomy (n = 60)	Prolonged Translaryngeal Intubation (n = 60)
Died (%)	19 (31.7)	37 (61.7)[a]
Pneumonia (%)	3 (5)	15 (25)[a]
Days in ICU ± SD	4.8 ± 1.4	16.2 ± 3.8[b]
Days mechanically ventilated ± SD	7.6 ± 4.0	17.4 ± 5.3[b]
Days sedated ± SD	3.2 ± 0.4	14.1 ± 2.9[b]
Days on high-dose pressors	3.5 ± 4	3.0 ± 4.5
Organism(s) causing pneumonia: Methicillin-	1	5
resistant *Staphylococcus aureus*, *Pseudomonas*	1	5
aeruginosa mixture	1	5

[a] $p < .005$; [b] $p < .001$. There was a significant difference between the early tracheotomy groups and the prolonged translaryngeal intubation group in outcome measures. Some patients were sent to a step-down while still on mechanical ventilation.

Rumback, Critical Care Medicine (2004);32(8):1689

Table 1 Summary of studies included in systematic review

Study	No of patients (n=406)	Timing of tracheostomy		Intensive care setting	Randomisation	Mortality expressed on intention to treat basis	Duration of ventilation and critical care stay expressed on intention to treat basis
		Early	Late				
Bouderka et al 2004[24]	62	5-6 days after admission	Prolonged endotracheal intubation	Unit for patients with head injuries	Randomised; method not stated	Implied	Implied both
Dunham et al 1984[25]	74	3-4 days after initiation of translaryngeal intubation	14 days after initiation of translaryngeal intubation	Trauma unit	Quasi-randomised	Mortality not recorded Pneumonia analysed by intention to treat	Yes
Rodriguez et al 1990[26]	106	1-7 days after admission to intensive care unit	8 or more days after admission to intensive care unit	Surgical unit	Quasi-randomised	Implied	Implied both
Rumbak et al 2004[17]	120	0-2 days after initiation of mechanical ventilation	14-16 days after initiation of mechanical ventilation	Three medical units	True randomisation	Implied	Yes
Saffle et al 2002[16]	44	Next available operative day	14 days after burn injury	Burns unit	True randomisation	Implied	Yes

Griffiths,British Journal of Medicine (2005); 330:1243

Study	Early tracheostomy n/N	Late tracheostomy n/N	Relative risk (random) 95% CI	Weight (%)	Relative risk (random) 95% CI
Bouderka et al 2004[24]	12/31	7/31		23.71	1.71 (0.78 to 3.77)
Rodriguez et al 1990[26]	9/51	13/35		24.53	0.75 (0.35 to 1.60)
Rumbak et al 2004[17]	19/60	37/60		35.71	0.51 (0.34 to 0.78)
Saffle et al 2002[16]	4/21	6/23		16.05	0.73 (0.24 to 2.23)
Total (95% CI)	163	169		100.00	0.79 (0.45 to 1.39)

χ^2=7.11, df=3

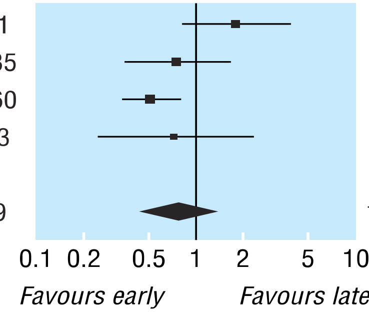


Fig 2 Random effects meta-analysis of relative risk (95% confidence interval) of mortality with early compared with late tracheostomy

Study	Early tracheostomy n/N	Late tracheostomy n/N	Relative risk (random) 95% CI	Weight (%)	Relative risk (random) 95% CI
Bouderka et al 2004[24]	18/31	19/31		19.18	0.95 (0.63 to 1.43)
Dunham et al 1984[25]	20/34	20/40		18.89	1.18 (0.77 to 1.79)
Rodriguez et al 1990[26]	40/51	53/55		27.62	0.81 (0.70 to 0.95)
Rumbak et al 2004[17]	3/60	15/60		5.29	0.20 (0.06 to 0.66)
Saffle et al 2002[16]	21/21	22/23		29.02	1.05 (0.96 to 1.14)
Total (95% CI)	197	209		100.00	0.90 (0.66 to 1.21)

χ^2=29.58, df=3

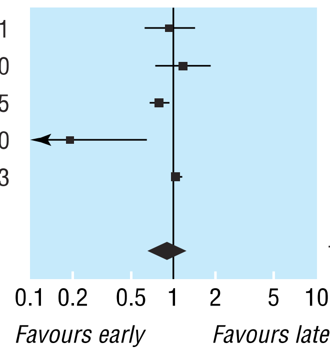


Fig 3 Random effects meta-analysis of relative risk (95% confidence interval) of hospital acquired pneumonia with early compared with late tracheostomy

Griffiths,British Journal of Medicine (2005); 330:1243

Study	Early tracheostomy		Late tracheostomy		Weight (%)	Weighted mean difference (random) 95% CI
	N	Mean (SD)	N	Mean (SD)		
Bouderka et al 2004[24]	31	14.50 (7.30)	31	17.50 (10.60)	28.34	-3.00 (-7.53 to 1.53)
Rodriguez et al 1990[26]	51	12.00 (7.14)	55	32.00 (22.25)	25.57	-20.00 (-26.20 to -13.80)
Rumbak et al 2004[17]	60	7.60 (4.00)	60	17.40 (5.30)	31.76	-9.80 (-11.48 to -8.12)
Saffle et al 2002[16]	21	35.50 (20.62)	23	31.40 (24.94)	14.32	4.10 (-9.38 to 17.58)
Total (95% CI)	163		169		100.00	-8.49 (-15.32 to -1.66)
χ^2=22.96, df=3						

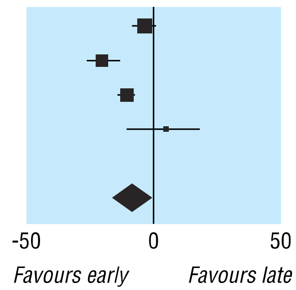


Fig 4 Random effects meta-analysis of weighted mean difference (95% confidence interval) of duration of ventilation in days

Study	Early tracheostomy		Late tracheostomy		Weight (%)	Weighted mean difference (random) 95% CI
	N	Mean (SD)	N	Mean (SD)		
Rodriguez et al 1990[26]	51	16.00 (7.14)	55	37.00 (29.66)	40.93	-21.00 (-29.08 to -12.92)
Rumbak et al 2004[17]	60	4.80 (1.40)	60	16.20 (3.80)	59.07	-11.40 (-12.42 to -10.38)
Total (95% CI)	111		115		100.00	-15.33 (-24.58 to -6.08)
χ^2=5.34, df=1						

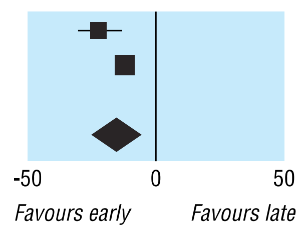
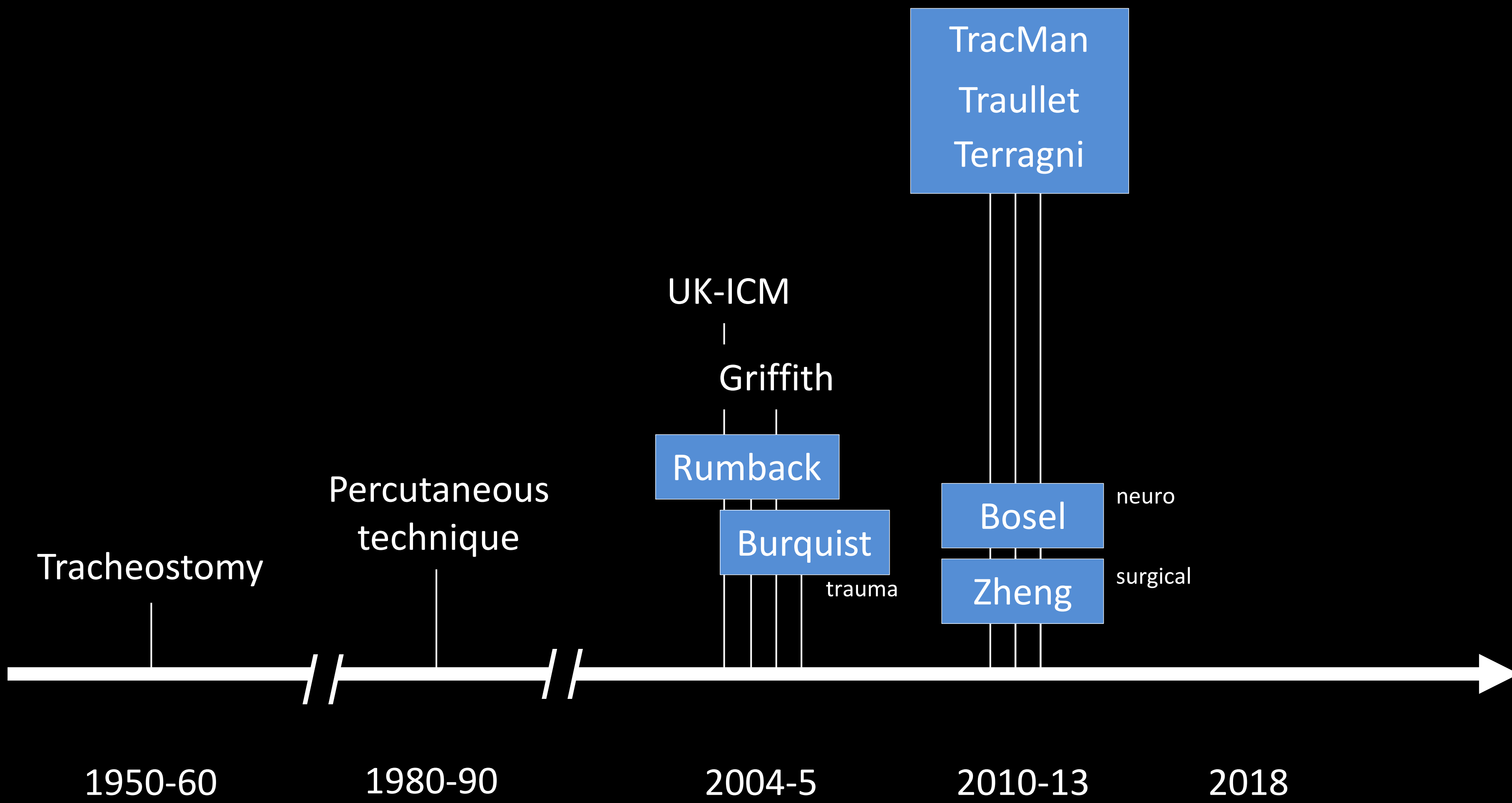


Fig 5 Random effects meta-analysis of weighted mean difference (95% confidence interval) of length of stay in the critical care unit in days

Griffiths,British Journal of Medicine (2005); 330:1243


TracMan
Traullet
Terragni
UK-ICM
Griffith
Rumback
Bosel
neuro
Percutaneous technique
Burquist
Zheng
surgical
Tracheostomy
trauma
1950-60
1980-90
2004-5
2010-13
2018

Early vs Late Tracheotomy for Prevention of Pneumonia in Mechanically Ventilated Adult ICU Patients

A Randomized Controlled Trial

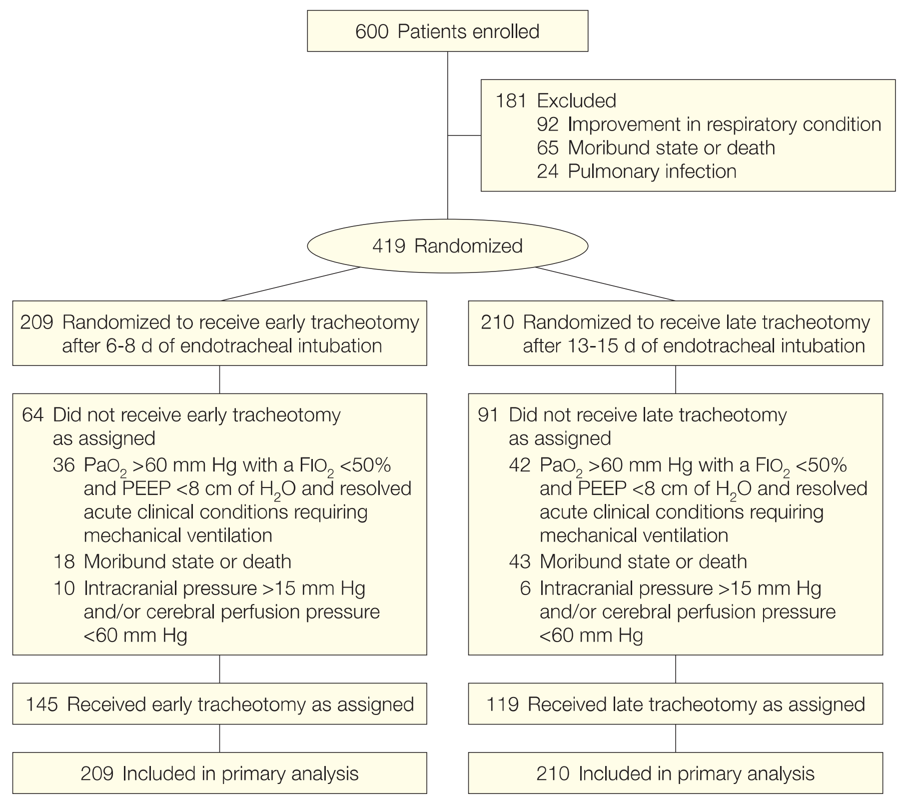


Figure 1. Flow of Patients in the Study

Terragni, JAMA (2010); 303(15):1483

Figure 2. Development of Ventilator-Associated Pneumonia According to Whether Patients Received an Early or a Late Tracheotomy

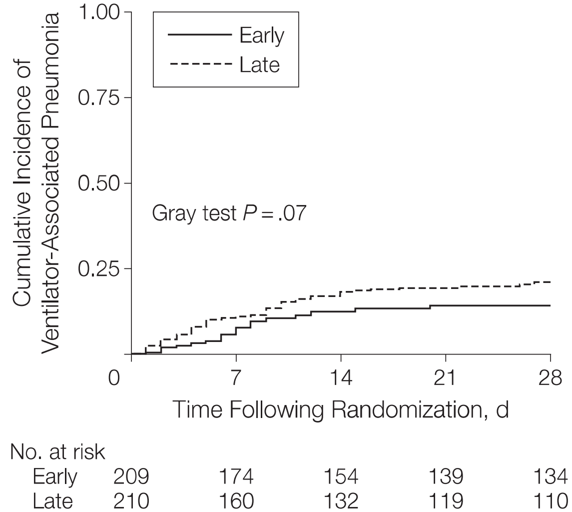


Table 3. Secondary Endpoints in the Early and Late Tracheotomy Groups

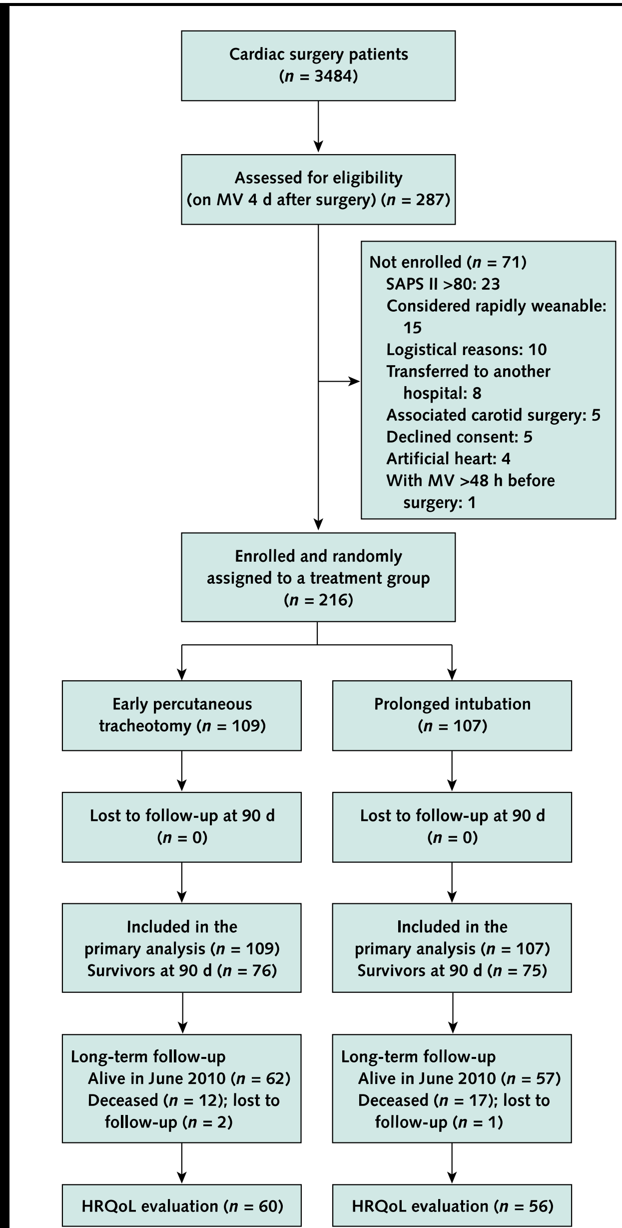
	Early Tracheotomy (n = 209)	Late Tracheotomy (n = 210)	*P* Value[a]
No. of days at 28 d, median (IQR)			
Ventilator-free	11 (0-21)	6 (0-17)	.02
ICU-free	0 (0-13)	0 (0-8)	.02
Successful weaning, No. (%) [95% CI], %	161 (77) [71-82]	142 (68) [61-74]	.002
ICU discharge, No. (%) [95% CI], %	101 (48) [42-55]	82 (39) [32-46]	.03
Survival at 28 d, No. (%) [95% CI], %	154 (74) [68-80]	144 (68) [63-75]	.25

Abbreviations: CI, confidence interval; ICU, intensive care unit; IQR, interquartile range.
[a] *P* values are 2-tailed (Wilcoxon signed rank test, log-rank test, and Gray test).

Terragni, JAMA (2010); 303(15):1483

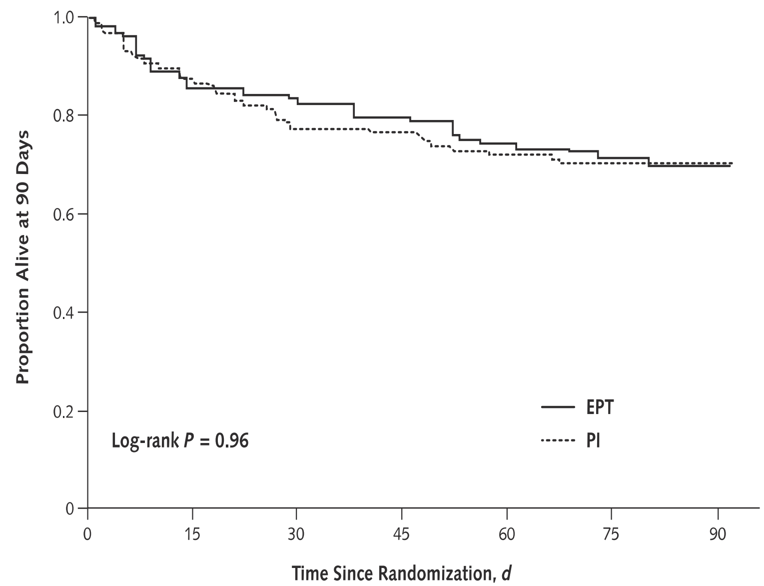
Early Percutaneous Tracheotomy Versus Prolonged Intubation of Mechanically Ventilated Patients After Cardiac Surgery

A Randomized Trial*



Trouillet, Ann Intern Med. 2011;154:373

Figure 2. **Kaplan–Meier estimates of survival probability.**



Persons at risk, *n*

	0	15	30	45	60	75	90
EPT	109	94	91	87	81	78	76
PI	107	94	83	82	77	75	75

Trouillet, Ann Intern Med. 2011;154:373

Table 2. **Short-Term Outcomes and Differences Between Treatment Groups**

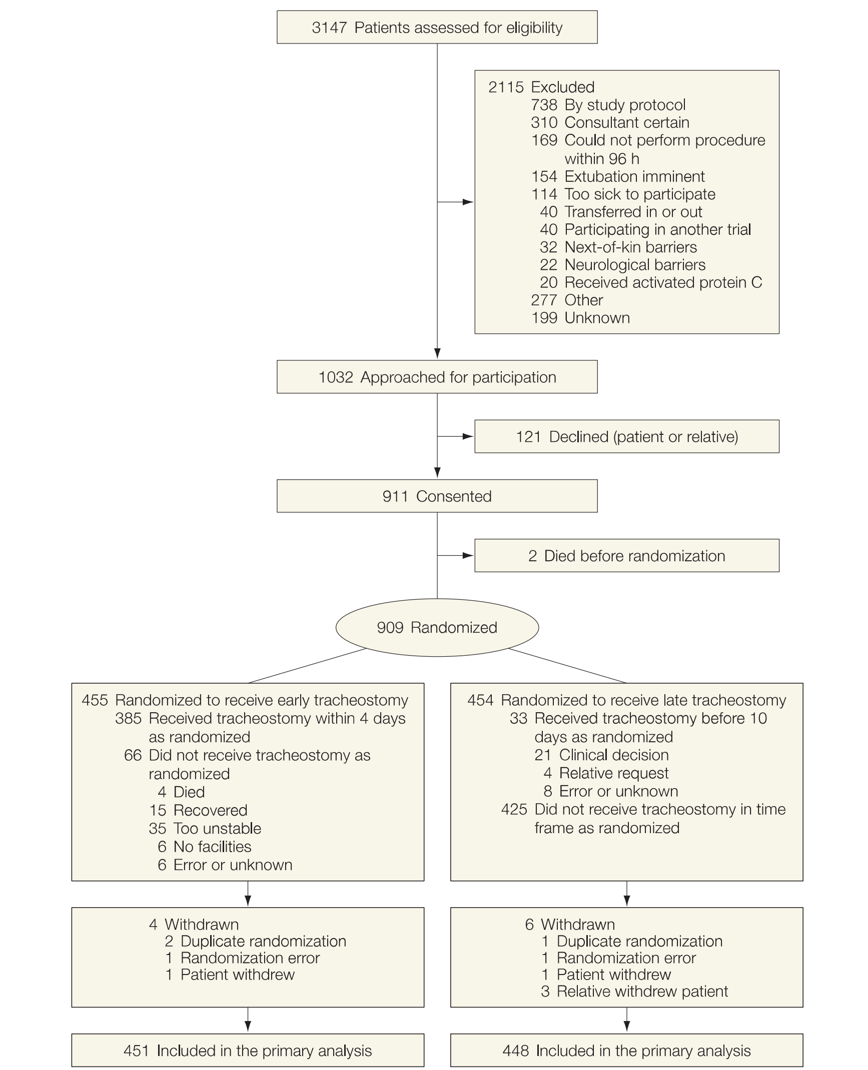
Variable	Early Percutaneous Tracheotomy (n = 109)	Prolonged Intubation (n = 107)	Mean Difference or Absolute Risk Difference (95% CI)	*P* Value
Mean VFDs during 1–60 d (SD)	30.4 (22.4)	28.3 (23.7)	2.1 (−4.1 to 8.3)	0.50
Mean VFDs during 1–28 d (SD)	10.0 (8.8)	9.2 (10.2)	0.8 (−1.7 to 3.4)	0.52
Mean VFDs during 1–90 d (SD)	49.3 (36.4)	47.5 (36.6)	1.8 (−8.0 to 11.6)	0.72
Mortality, *n (%)*				
28 d	17 (16)	23 (21)	−5.9 (−16.2 to 4.4)	0.30
60 d	28 (26)	30 (28)	−2.3 (−14.2 to 9.5)	0.76
90 d	33 (30)	32 (30)	0.4 (−11.9 to 12.6)	1.00
Mean length of ICU stay (SD), *d*	23.9 (21.3)	25.5 (22.2)	−1.5 (−7.4 to 4.3)	0.85
Mean length of hospital stay (SD), *d*	39.0 (27.0)	37.5 (26.9)	1.5 (−5.7 to 8.8)	0.56
Mean days of MV during 1−60 d (SD)	17.9 (14.9)	19.3 (16.9)	−1.3 (−5.6 to 3.0)	0.55
Mean endotracheal prosthesis-free days during 1–60 d (SD)	30.3 (22.5)	28.6 (24.1)	1.7 (−4.6 to 7.9)	0.60
Patients with unscheduled extubation or decannulation during 1–60 d, *n (%)**	3 (3)	17 (16)	−13.1 (−20.7 to −5.6)	<0.001
Patients with reintubation or recannulation during 1–60 d, *n (%)*†	17 (16)	35 (33)	−17.1 (−28.3 to −5.9)	0.003
Patients with noninvasive ventilation >4 h/d (during 1–60 d), *n (%)*	11 (10)	27 (25)	−15.1 (−25.1 to −5.2)	0.004
Sedation				
Mean duration of intravenous sedation (SD), *d*‡	6.4 (5.9)	9.6 (7.3)	−3.2 (−5.0 to −1.3)	0.007
Mean sedation-free days during 1–28 d (SD)	19.0 (9.1)	15.5 (9.3)	4.5 (1.2 to 6.9)	0.005
Mean cumulative sufentanil dose during 1–15 d (SD), *µg/kg*	4.0 (6.5)	10.2 (18.2)	−6.2 (−9.9 to −2.5)	0.001
Mean cumulative propofol dose during 1–15 d (SD), *mg/kg*	32.9 (60.2)	67.8 (116.7)	−34.9 (−60.1 to −9.8)	0.004
Mean cumulative midazolam dose during 1–15 d (SD), *mg/kg*	2.7 (4.7)	6.4 (14.3)	−3.7 (−6.6 to −0.8)	0.01
Mean days (during 1−15 d) of haloperidol therapy (SD)	1.9 (3.0)	3.2 (4.2)	−1.3 (−2.3 to −0.3)	0.01
Mean cumulative haloperidol dose during 1–15 d (SD), *mg/kg*	0.26 (0.51)	0.57 (0.92)	−0.3 (−0.5 to −0.1)	0.002
VAP after randomization, *n (%)*	50 (46)	47 (44)	2.0 (−11.3 to 15.2)	0.77
Sternal wound infection, *n (%)*	14 (13)	14 (13)	−0.2 (−9.2 to 8.7)	0.96
Bloodstream infection, *n (%)*	18 (17)	16 (15)	1.5 (−8.1 to 11.3)	0.85
Mean days (during 1−15 d) nurse-assessed as comfortable (SD)	11.8 (3.8)	10.4 (4.4)	1.4 (0.3 to 2.5)	0.01
Mean days (during 1−15 d) with nurse-assessed easy management (SD)	12.0 (3.8)	10.8 (4.4)	1.2 (0.05 to 2.3)	0.04
Received oral nutrition at 15 d, *n (%)*	91 (83)	57 (53)	30.2 (18.5 to 42.2)	<0.001
Bed-to-chair transfer at 15 d, *n (%)*	72 (66)	47 (44)	22.1 (9.2 to 35.1)	0.002
Muscle strength assessment (SD)§				
14 d (n = 76, 68)	156.9 (87.0)	134.9 (92.8)	22.0 (−7.7 to 51.6)	0.15
28 d (n = 36, 36)	164.0 (86.1)	176.9 (85.6)	−12.9 (−53.3 to 27.5)	0.52
42 d (n = 21, 21)	170.1 (86.4)	195.4 (67.5)	−25.3 (−73.6 to 23.1)	0.30
56 d (n = 8, 11)	149.7 (70.4)	185.4 (76.0)	−35.7 (−108.0 to 36.6)	0.31

Trouillet, Ann Intern Med. 2011;154:373

Effect of Early vs Late Tracheostomy Placement on Survival in Patients Receiving Mechanical Ventilation

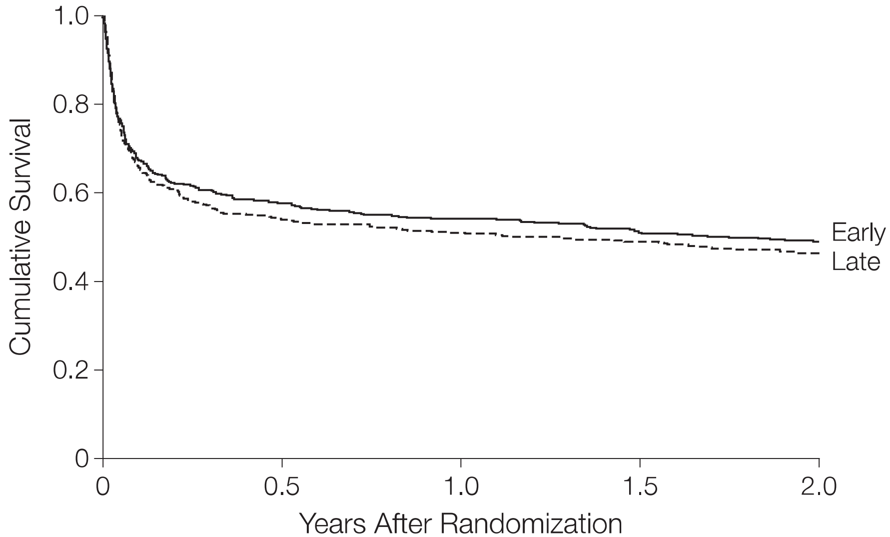
The TracMan Randomized Trial

Figure 1. The TracMan Study Flow Diagram



Young, JAMA (2013);309:2122

Figure 3. Kaplan-Meier Survival Curve to 2 Years After Randomization



No. at risk					
Early	451	261	244	230	221
Late	448	242	226	217	205

The survival of patients by treatment group for 2 years after randomization (*P* = .45, Cox-Mantel log rank test).

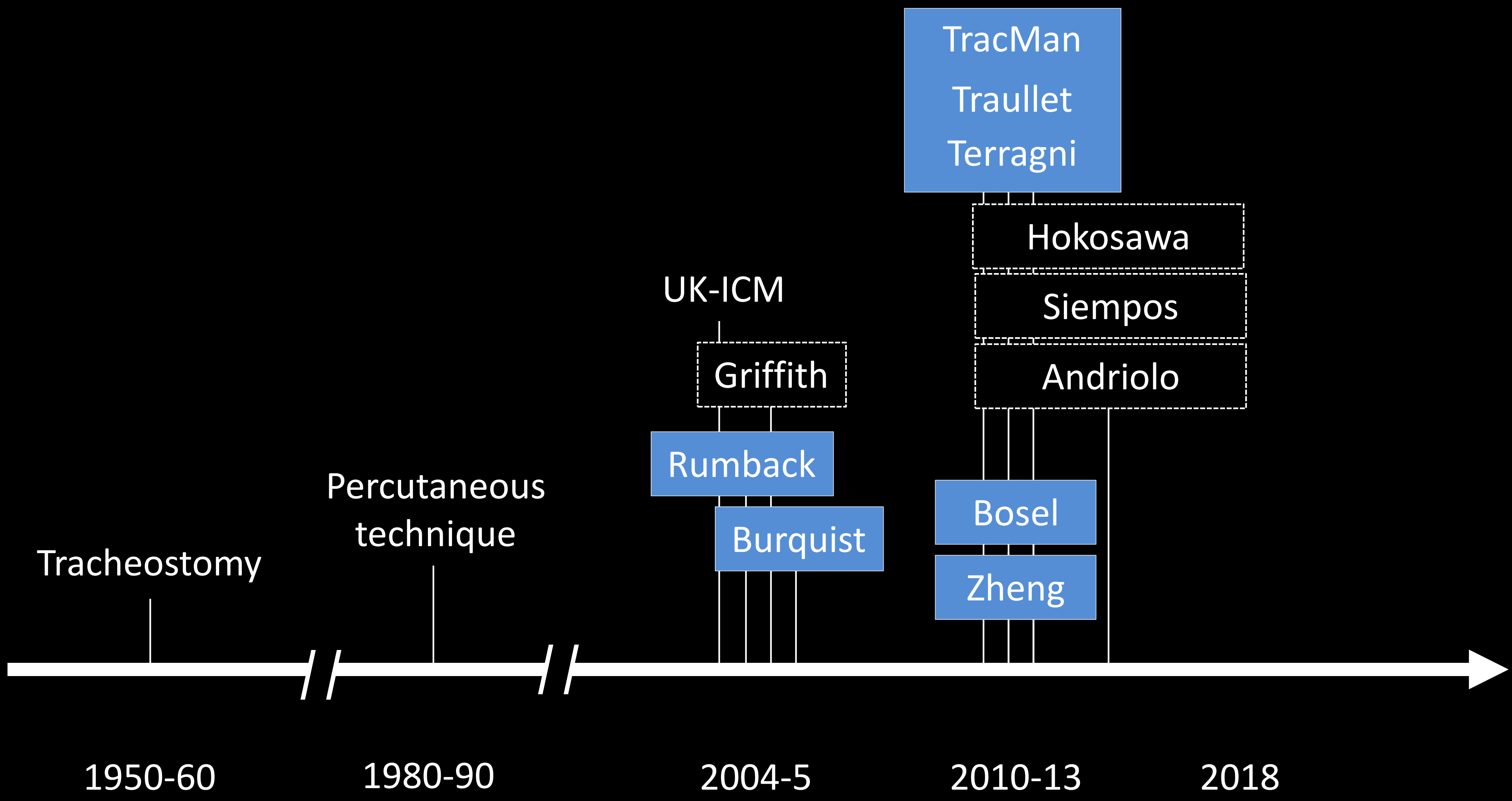
Young, JAMA (2013);309:2122

Table 3. Primary Outcome and Secondary Mortality Outcome Measures

	No. (%) of Patients [95% CI]			Absolute Risk Reduction for Early vs Late (95% CI), %	Relative Risk for Early vs Late (95% CI)	*P* Value for Fisher Exact Test
	Early (n = 451)	Late (n = 448)	Total (n = 899)			
Status at 30 d (primary outcome)						
Died	139 (30.8) [26.7 to 35.2]	141 (31.5) [27.3 to 35.9]	280 (31.2) [28.2 to 34.3]	0.7 (−5.4 to 6.7)	0.98 (0.81 to 1.19)	.89
Status at ICU discharge[a]						
No. of patients	448	445	893			
Died	133 (29.7) [25.6 to 34.1]	132 (29.7) [25.6 to 34.1]	265 (29.7) [26.8 to 32.8]	0.0 (−6.0 to 6.0)	1.00 (0.82 to 1.22)	>.99
Status at hospital discharge[b]						
No. of patients	424	436	860			
Died	168 (39.6) [35.1 to 44.4]	180 (41.3) [36.8 to 46.0]	348 (40.5) [37.2 to 43.8]	1.7 (−4.9 to 8.2)	0.96 (0.82 to 1.13)	.63
Status at 1 y[c]						
No. of patients	451	443	894			
Died	207 (45.9) [41.4 to 50.5]	217 (49.0) [44.4 to 53.6]	424 (47.4) [44.2 to 50.7]	3.1 (−3.5 to 9.6)	0.94 (0.82 to 1.08)	.38
Status at 2 y[d]						
No. of patients	451	443	894			
Died	230 (51.0) [46.4 to 55.6]	238 (53.7) [49.1 to 58.3]	468 (52.3) [49.1 to 55.6]	0.7 (−3.8 to 9.3)	0.95 (0.84 to 1.08)	.42

Abbreviation: ICU, intensive care unit.
[a] Status at critical care unit discharge not available for 6 patients (3 early, 3 late).
[b] Status at hospital discharge not available for 39 patients (27 early, 12 late).
[c] Status at 1 y not available for 5 patients (5 late).
[d] Status at 2 y not available for 5 patients (5 late).

Young, JAMA (2013);309:2122



TracMan
Traullet
Terragni
Hokosawa
UK-ICM
Siempos
Griffith
Andriolo
Rumback
Percutaneous technique
Bosel
Burquist
Tracheostomy
Zheng
1950-60
1980-90
2004-5
2010-13
2018

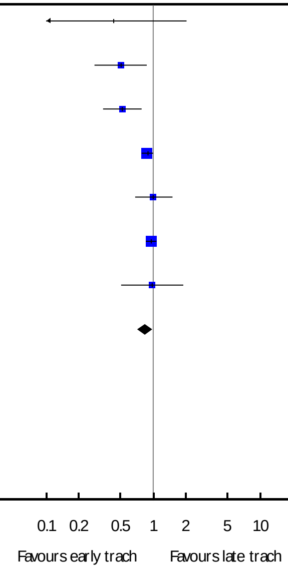
Analysis 1.1. Comparison 1 Early vs late tracheostomy, Outcome 1 Mortality at longest follow-up time available in studies.

Review: Early versus late tracheostomy for critically ill patients

Comparison: 1 Early vs late tracheostomy

Outcome: 1 Mortality at longest follow-up time available in studies

Study or subgroup	Early tracheostomy n/N	Late tracheostomy n/N	Weight	Risk Ratio M-H,Random,95% CI
Barquist 2006	2/29	5/31	1.2 %	0.43 [0.09, 2.03]
Bösel 2013	10/30	20/30	7.5 %	0.50 [0.28, 0.88]
Rumbak 2004	19/60	37/60	11.6 %	0.51 [0.34, 0.78]
Terragni 2010	137/209	155/210	30.8 %	0.89 [0.78, 1.01]
Trouillet 2011	33/109	32/107	12.2 %	1.01 [0.67, 1.52]
Young 2013	234/455	244/454	31.1 %	0.96 [0.85, 1.08]
Zheng 2012	13/58	14/61	5.8 %	0.98 [0.50, 1.90]
Total (95% CI)	**950**	**953**	**100.0 %**	**0.83 [0.70, 0.98]**



Total events: 448 (Early tracheostomy), 507 (Late tracheostomy)

Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 13.19$, df = 6 (P = 0.04); $I^2 = 55\%$

Test for overall effect: Z = 2.14 (P = 0.032)

Test for subgroup differences: Not applicable

Andriolo, Cochrane Database Syst Rev (2015):1:CD007271

	Early tracheostomy		Late or no tracheostomy		Weight	Odds ratio, random (95% CI)
	Deaths	Total	Deaths	Total		
Young et al 2013[3]	133	448	132	445	16·7%	1·00 (0·75–1·33)
Bösel et al 2013[15]	3	30	14	30	3·9%	0·13 (0·03–0·51)
Koch et al 2012[16]	9	50	7	50	5·8%	1·35 (0·46–3·96)
Zheng et al 2012[17]	8	58	6	61	5·5%	1·47 (0·48–4·52)
Trouillet et al 2011[4]	24	109	26	107	10·7%	0·88 (0·47–1·66)
Terragni et al 2010[5]	55	209	66	210	14·3%	0·78 (0·51–1·19)
Blot et al 2008[19]	12	61	15	62	7·8%	0·77 (0·33–1·81)
Barquist et al 2006[20]	2	29	5	31	2·8%	0·39 (0·07–2·16)
Bouderka et al 2004[21]	12	31	7	31	5·6%	2·17 (0·71–6·57)
Rumbak et al 2004[22]	19	60	37	60	9·1%	0·29 (0·14–0·61)
Saffle et al 2002[23]	4	21	6	23	3·8%	0·67 (0·16–2·79)
Sugerman et al 1997[24]	13	53	11	59	7·3%	1·42 (0·57–3·51)
Rodriguez et al 1990[25]	9	51	13	55	6·9%	0·69 (0·27–1·79)
Total		**1210**		**1224**	**100·0%**	**0·80 (0·59–1·09)**
Total deaths	303		345			

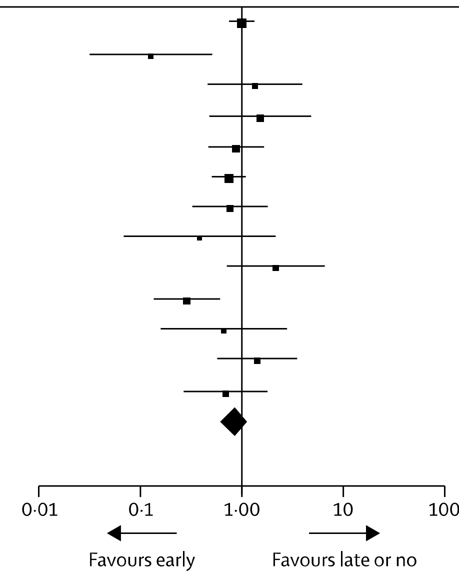
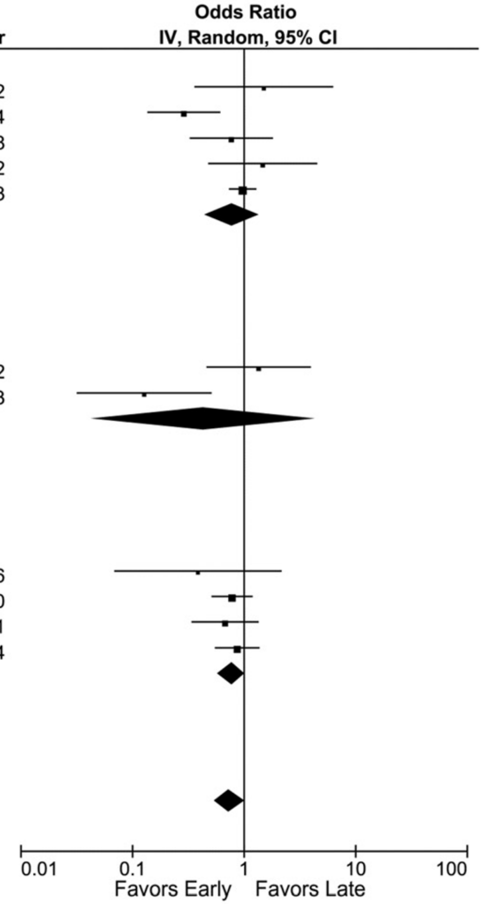


***Figure 2*: Mortality in the intensive care unit and early tracheostomy**

Mortality in the intensive-care unit was a composite endpoint of definite intensive-care-unit mortality, presumed intensive-care-unit mortality, and 28-day mortality. We calculated pooled odds ratio and 95% CIs with a random-effects model. Total refers to number of patients assigned to each group.

Siempos, Lancet Respir Med (2015);3:150 a)

Study or Subgroup	Early Events	Early Total	Late Events	Late Total	Weight	Odds Ratio IV, Random, 95% CI	Year
Early, within 4 days; Late, after 10 days							
Saffle 2002 [38]	17	21	17	23	3.7%	1.50 [0.36, 6.28]	2002
Rumbak 2004 [16]	19	60	37	60	9.5%	0.29 [0.14, 0.61]	2004
Blot 2008 [40]	12	61	15	62	8.1%	0.77 [0.33, 1.81]	2008
Zheng 2012 [41]	8	58	6	61	5.5%	1.47 [0.48, 4.52]	2012
Young 2013 [19]	139	451	141	448	19.3%	0.97 [0.73, 1.29]	2013
Subtotal (95% CI)		**651**		**654**	**46.1%**	**0.79 [0.45, 1.38]**	
Total events	195		216				
Heterogeneity: Tau² = 0.22; Chi² = 10.31, df = 4 (P = 0.04); I² = 61%							
Test for overall effect: Z = 0.82 (P = 0.41)							
Early, within 4 days; Late, after 5 days							
Koch 2012 [42]	9	50	7	50	5.9%	1.35 [0.46, 3.96]	2012
Bösel 2013 [43]	3	30	14	30	3.9%	0.13 [0.03, 0.51]	2013
Subtotal (95% CI)		**80**		**80**	**9.8%**	**0.43 [0.04, 4.37]**	
Total events	12		21				
Heterogeneity: Tau² = 2.39; Chi² = 6.93, df = 1 (P = 0.008); I² = 86%							
Test for overall effect: Z = 0.71 (P = 0.48)							
Early, within 10 days; Late, after 10 days							
Barquist 2006 [39]	2	29	5	31	2.7%	0.39 [0.07, 2.16]	2006
Terragni 2010 [17]	55	209	66	210	15.9%	0.78 [0.51, 1.19]	2010
Trouillet 2011 [18]	17	109	23	107	10.4%	0.67 [0.34, 1.35]	2011
Diaz-Prieto 2014 [25]	42	245	47	244	15.1%	0.87 [0.55, 1.37]	2014
Subtotal (95% CI)		**592**		**592**	**44.1%**	**0.78 [0.59, 1.03]**	
Total events	116		141				
Heterogeneity: Tau² = 0.00; Chi² = 1.01, df = 3 (P = 0.80); I² = 0%							
Test for overall effect: Z = 1.76 (P = 0.08)							
Total (95% CI)		**1323**		**1326**	**100.0%**	**0.74 [0.55, 1.00]**	
Total events	323		378				
Heterogeneity: Tau² = 0.10; Chi² = 19.37, df = 10 (P = 0.04); I² = 48%							
Test for overall effect: Z = 1.95 (P = 0.05)							
Test for subgroup differences: Chi² = 0.25, df = 2 (P = 0.88), I² = 0%							



Hokosawa, Crit Care (2015);19:424

Table 2
Studies comparing early and late tracheostomy

Author/year	n	Definition of early tracheostomy	Definition of late tracheostomy	Type of ICU	Mortality difference
Barquist, 2006 [29]	60	≤d 8	≥d 28	Trauma	0.43 (0.09-2.03)
Bosel, 2013 [28]	60	≤3 d after orotracheal intubation	7-14 d after orotracheal intubation	Neurology or neurosurgery	0.5 (0.28-0.88)
Rumbak, 2004 [27]	120	≤48 h after orotracheal intubation	Days 14-16 of MV	Medical	0.51 (0.34-0.78)
Terragni, 2010 [30]	419	6-8 d after orotracheal intubation	13-15 d after orotracheal intubation	12 ICUs, type not specified	0.89 (0.78-1.01)
Trouillet, 2011 [31]	216	≤5 d after surgery	≥d 15 after surgery	Cardiac surgery	1.01 (0.67-1.52)
Young, 2013 [32]	909	≤4 d of MV	≥10 d of MV	2 medical and 2 cardiothoracic ICUs	0.96 (0.85-1.08)
Zheng, 2012 [33]	119	Day 3 of MV	Day 15 of MV	Surgical	0.98 (0.5-1.9)

We do not reccomend early tracheostomy

5.1 to reduce long-term mortality

5.2 to reduce the risk of pneumonia

5.3 to reduce the number of days spent in ICU

5.5 to prevent laryngotracheal complications

We reccomend early tracheostomy

5.5 to decrease the duration of mechanical ventilation

Raimondi, Journal of Crit Care (2017);38:304

Table 2. Outcome measures

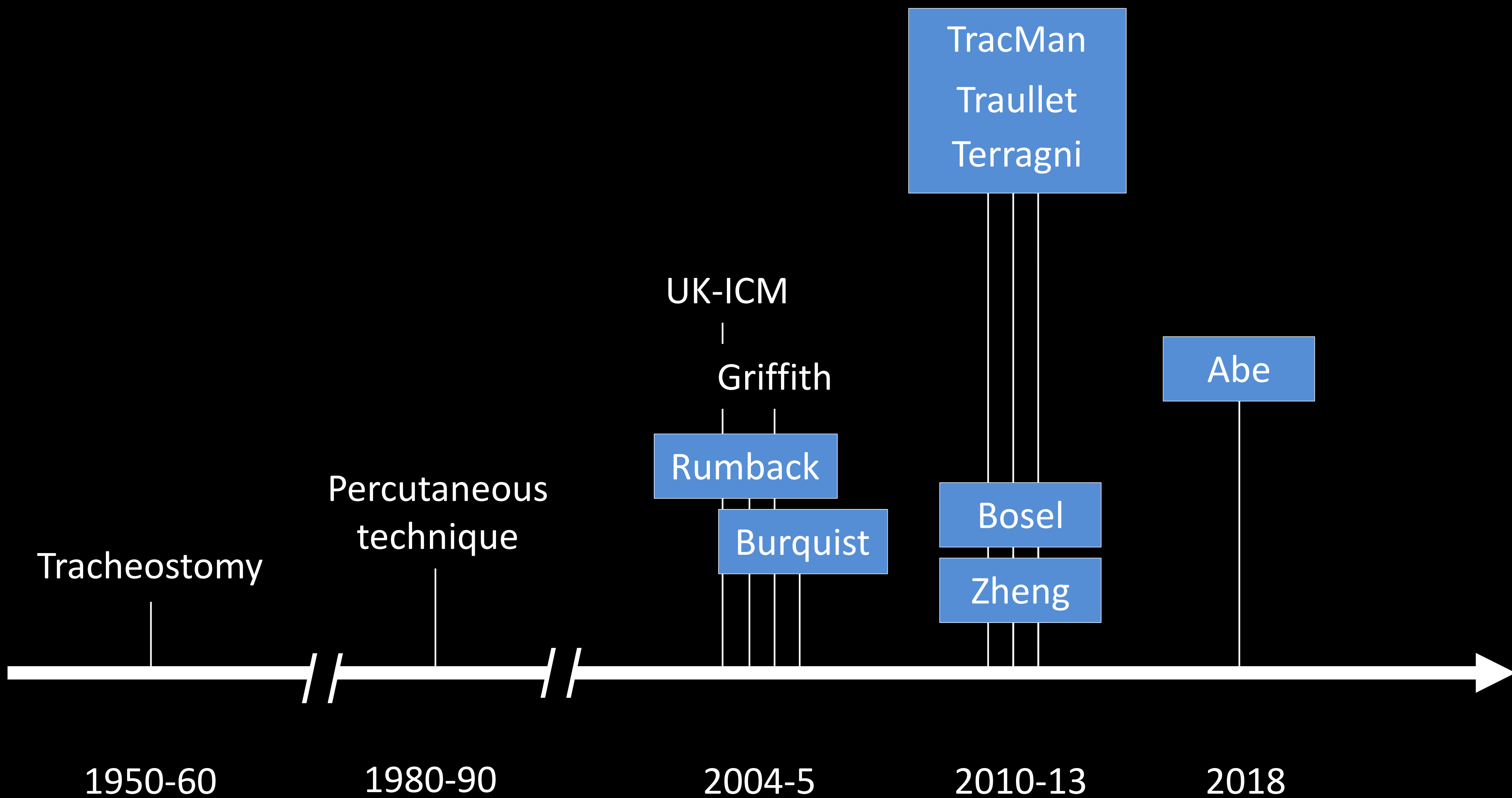
Outcome Measurement	Early Tracheotomy (n = 60)	Prolonged Translaryngeal Intubation (n = 60)
Died (%)	19 (31.7)	37 (61.7)[a]
Pneumonia (%)	3 (5)	15 (25)[a]
Days in ICU ± SD	4.8 ± 1.4	16.2 ± 3.8[b]
Days mechanically ventilated ± SD	→ 7.6 ± 4.0	17.4 ± 5.3[b]
Days sedated ± SD	3.2 ± 0.4	14.1 ± 2.9[b]
Days on high-dose pressors	3.5 ± 4	3.0 ± 4.5
Organism(s) causing pneumonia: Methicillin-	1	5
resistant *Staphylococcus aureus*, *Pseudomonas*	1	5
aeruginosa mixture	1	5

[a] $p < .005$; [b] $p < .001$. There was a significant difference between the early tracheotomy groups and the prolonged translaryngeal intubation group in outcome measures. Some patients were sent to a step-down while still on mechanical ventilation.

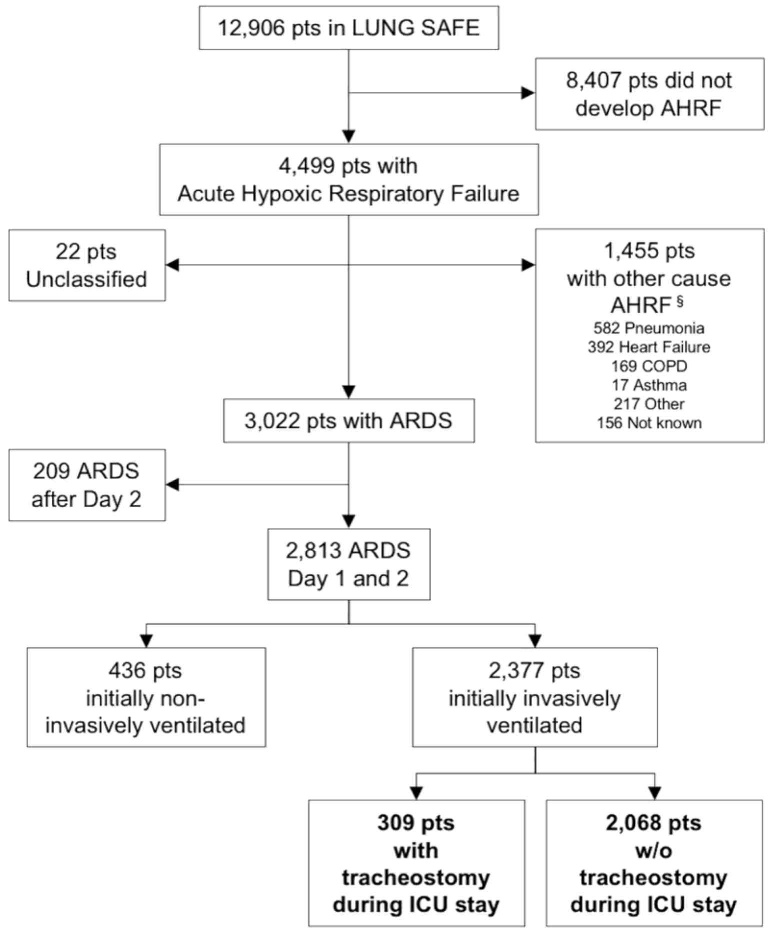
Hokosawa, Crit Care (2015);19:424

Terragni, JAMA (2010); 303(15):1483

Rumback, Critical Care Medicine (2004);32(8):1689



Tracheostomy
Percutaneous technique
UK-ICM
Griffith
Rumback
Burquist
TracMan
Traullet
Terragni
Bosel
Zheng
Abe
1950-60
1980-90
2004-5
2010-13
2018



Abe, Critical Care (2018) 22:195

13% of the investigated population

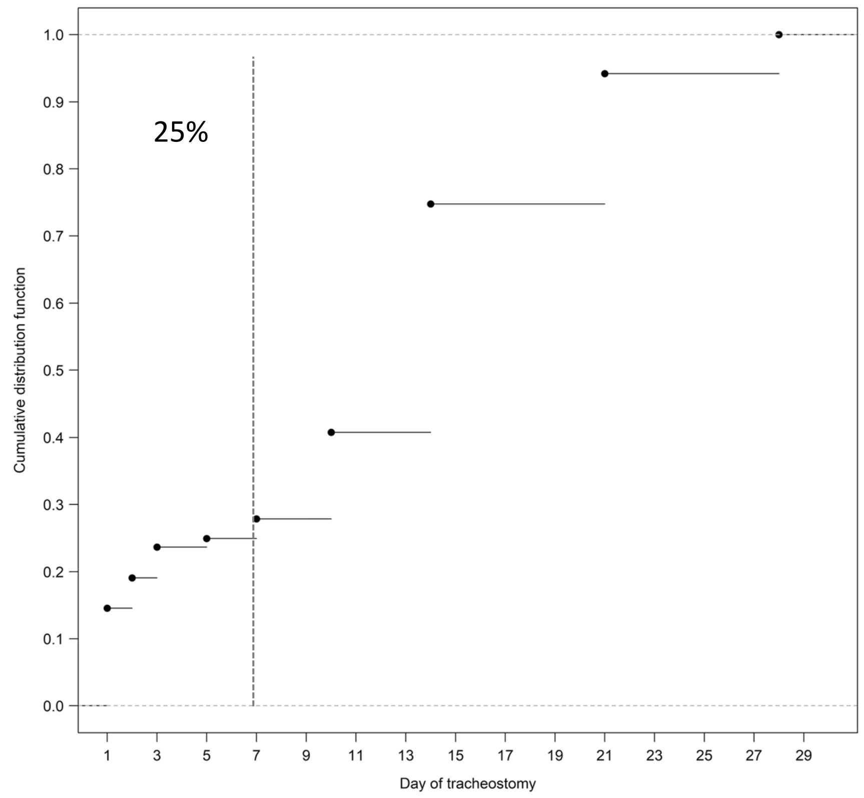


Fig. 2 Distribution of time to tracheostomy (*n* = 309)

Abe, Critical Care (2018) 22:195

Longer MV, ICU stay, HH stay

Table 2 Outcomes in patients with tracheostomy and patients with no tracheostomy ($n = 2377$)

	Tracheostomy Number (%) or median (Q1-Q3)	No tracheostomy Number (%) or median (Q1-Q3)	*P* value
Days of mechanical ventilation			
All patients	21.5 (13–33)	7 (4–13)	<.0001
Patient alive at hospital discharge	21 (14–32)	7 (4–12)	<.0001
Ventilator-free days			
All patients	0 (0–13)	15 (0–23)	<.0001
Patient alive at hospital discharge ($n = 181$, $n = 1114$)	8 (0–15)	22 (17–25)	<.0001
Length of ICU stay (days)°			
All patients	11 (5–23)	8 (4–15)	<.0001
Patient alive at hospital discharge ($n = 229$, $n = 1309$)	12 (6–24)	9 (5–16)	0.0005
Length of hospital stay (days)°			
All patients	24 (9–44)	14 (7–27)	<.0001
Patient alive at hospital discharge ($n = 200$, $n = 1165$)	29.5 (15–50.5)	20 (12–35)	<.0001

SD standard deviation, *ICU* intensive care unit, *Q1–Q3* 25th–75th percentile
°For tracheostomized patients, length of stay was calculated from the "approximate" date of tracheostomy
*Mortality was evaluated according to the vital status at 28/60/90 days from acute respiratory distress syndreom onset or from the "nearest recorded" date of tracheostomy in non tracheostomized and tracheostomized patients, respectively. If the patient was discharged alive before 28/60/90 days, we considered the patient as alive

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Lower crude mortality

Table 2 Outcomes in patients with tracheostomy and patients with no tracheostomy ($n = 2377$)

	Tracheostomy Number (%) or median (Q1-Q3)	No tracheostomy Number (%) or median (Q1-Q3)	*P* value
Days of mechanical ventilation			
All patients	21.5 (13–33)	7 (4–13)	<.0001
Patient alive at hospital discharge	21 (14–32)	7 (4–12)	<.0001
Ventilator-free days			
All patients	0 (0–13)	15 (0–23)	<.0001
Patient alive at hospital discharge ($n = 181$, $n = 1114$)	8 (0–15)	22 (17–25)	<.0001
Length of ICU stay (days)°			
All patients	11 (5–23)	8 (4–15)	<.0001
Patient alive at hospital discharge ($n = 229$, $n = 1309$)	12 (6–24)	9 (5–16)	0.0005
Length of hospital stay (days)°			
All patients	24 (9–44)	14 (7–27)	<.0001
Patient alive at hospital discharge ($n = 200$, $n = 1165$)	29.5 (15–50.5)	20 (12–35)	<.0001
Hospital mortality			
28-day* ($n = 308$, $n = 2061$)	72 (23.4)	786 (38.1)	<.0001
60-day* ($n = 308$, $n = 2061$)	91 (29.5)	847 (41.1)	0.0001
90-day* ($n = 308$, $n = 2061$)	95 (30.8)	861 (41.8)	0.0003
Limitation of life-sustaining therapies or measures decision ($n = 308$, $n = 2061$)	63 (20.4)	515 (24.9)	0.0844

SD standard deviation, *ICU* intensive care unit, *Q1–Q3* 25th–75th percentile
°For tracheostomized patients, length of stay was calculated from the "approximate" date of tracheostomy
*Mortality was evaluated according to the vital status at 28/60/90 days from acute respiratory distress syndreom onset or from the "nearest recorded" date of tracheostomy in non tracheostomized and tracheostomized patients, respectively. If the patient was discharged alive before 28/60/90 days, we considered the patient as alive

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Tracheostomy delays death

Table 4 Description of outcomes in the propensity-matched sample (n = 534)

	Tracheostomy (*n* = 267) Number (%) or median (Q1–Q3)	No tracheostomy (*n* = 267) Number (%) or median (Q1–Q3)	*P* value
Days of mechanical ventilation			
All patients	22 [13–33.5]	8 [4–12]	<.0001
Patient alive at hospital discharge	22 [13.5–33]	6 [3–11]	<.0001
Ventilator-free days			
All patients	0 [0–11]	18 [0–25]	<.0001
Patient alive at hospital discharge	7 [0–15.5]	23 [18–26]	<.0001
Length of ICU stay (days)°			
All patients	11 [5–24]	8 [5–14]	<.0001
Patient alive at hospital discharge	12 [6–25]	8 [5–14]	0.0002
Length of hospital stay (days)°			
All patients	24 [9–43]	17 [10–31]	0.0190
Patient alive at hospital discharge	31 [15.5–50.5]	23 [13–38]	0.0325
Hospital mortality			
28-day*	61 (22.9)	85 (31.8)	0.0197
60-day*	78 (29.3)	97 (36.3)	0.0814
90-day*	81 (30.5)	102 (38.2)	0.0549
Limitation of life-sustaining therapies or measures decision	53 (19.9)	59 (22.1)	0.5900

Statistical tests accounted for the matched nature of the sample (paired *t* test or Wilcoxon signed-rank test for continuous variables, McNemar's test for dichotomous variables)
°For tracheostomized patients, length of stay was valuated from the "approximate" date of tracheostomy
*Mortality was evaluated according to the vital status at 28/60/90 days from acute respiratory distress syndrome onset or from the "nearest recorded" date of tracheostomy for non-tracheostomized and tracheostomized patients, respectively. If the patient was discharged alive before 28/60/90 days, we considered the patient as alive

Propensity-matched analysis

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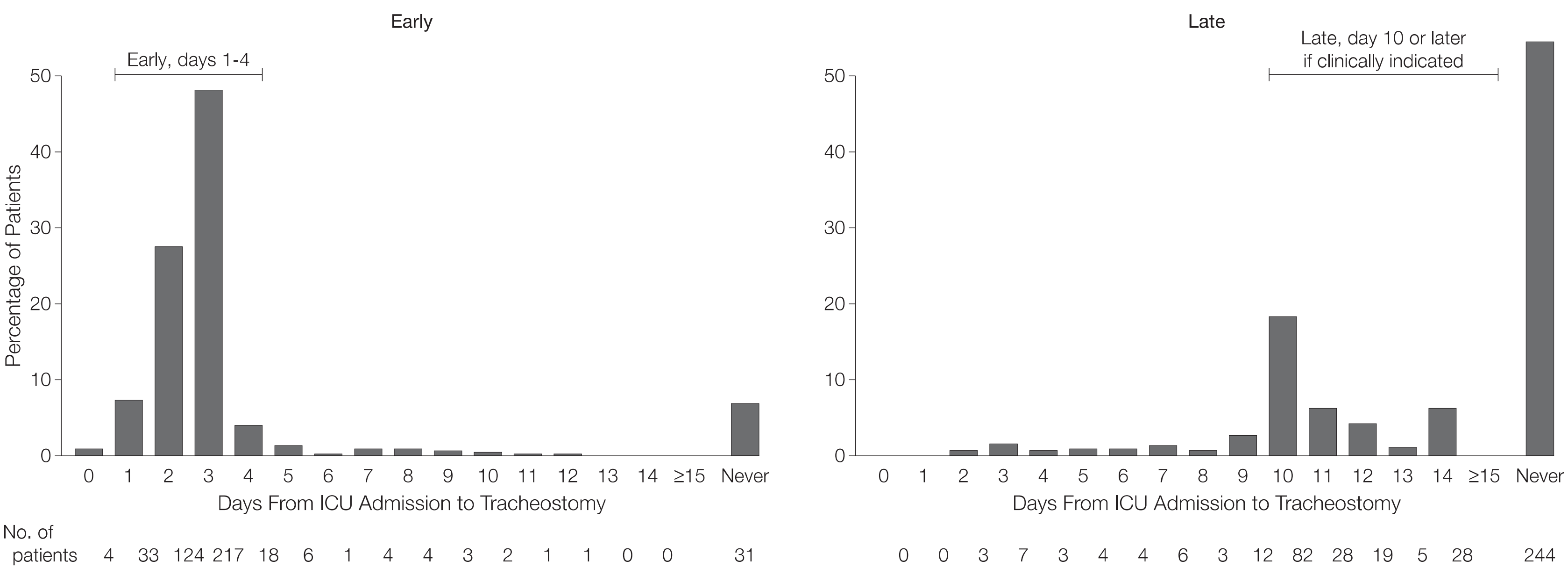
Figure 2. The Distribution of Tracheostomy Timings in the Early and Late Tracheostomy Groups



There were 622 tracheostomies performed. ICU indicates intensive care unit.

Young, JAMA (2013);309:2122

… in conclusion

Not to improve long term outcome

To maintain the airway
e.g. reduced level of consciousness, upper-airway obstruction, intubation difficulties

To provide some protection to the airway
e.g. bulbar palsy

For bronchial toilet
e.g. excessive secretions/inadequate cough

For weaning from IPPV
e.g. patient comfort, reduction of sedation

Possibly delaying at least to day 10