Author Year Country Research Design Score Sample Size	Methods	Outcome
Anand et al. 2020 USA Case control Level 3 N = 5980	**Population:** 5980 participants with traumatic cervical SCI; 4365 males and 1615 females; mean (SD) age 46 ± 22 years, median ISS 19 (10-28); high cervical SCI (C1-C4) (48%) and lower cervical SCI (C5-C7) (52%); 17% of patients had complete injury and 2.4% had central spinal cord syndrome. **Treatment:** Participants were divided in two groups based on the timing of performing tracheostomy: • ET: Performed from 1-4 days after intubation (n = 1010). • LT: Performed from day 5 after intubation (n = 4970). **Outcome Measures:** Respiratory complications, ventilator days, in-hospital mortality, and ICU and hospital LOS. **Chronicity:** Time since injury was not specified.	1. Compared with patients in the LT group, ET group patients had: a. Lower rates of respiratory complications (30% vs. 46%, p = 0.01). b. Higher ventilator-free days (13 days vs. 9 days, p = 0.02). c. ICU- free days (11 days vs. 8 days, p = 0.01). d. A shorter hospital LOS (22 days vs. 29 days, p = 0.01). 2. On regression analysis, after adjusting for measurable confounding factors: a. ET was associated with lower rates of respiratory complications in patients with high CSCI (OR, 0.55 [0.41–0.81]) and low CSCI (OR, 0.93 [0.72–0.95]). b. No association was found between time to tracheostomy and in-hospital mortality (OR, 1.04 [0.95–1.49]).
Wang et al. 2021 China Case control Level 3 N = 124	**Population:** 124 patients with cervical SCI who underwent ACFS and received percutaneous tracheotomy after surgery in the ICU; 107 males and 17 females, mean (SD) age 43.20 (± 14.68) years; AISA A (n = 72), ASIA B (n = 27) and ASIA C (n = 15). **Treatment:** Patients were divided into three groups	1. There were no intergroup differences in the radiographic parameters. 2. The late group needed significantly longer duration of MV and longer ICU LOS than the early and medium groups (p ≤ 05). 3. Significantly less ICU mortality and pneumonia after tracheotomy in the

	based on the timing of tracheotomy when they received: • Early group (≤4 days from initial intubation). • Medium group (4–10 days from initial intubation). • Late group (≥10 days from initial intubation). **Outcome Measures:** Mortality, ICU LOS, duration of ventilation, incidence of pneumonia after tracheotomy, Japanese Orthopedic Association (JOA) scores, Neck Disability Index (NDI), and radiographic parameters (maximum spinal cord compression (MSCC), and lesion length (LL)). **Chronicity:** Time since injury were not specified but patients were included if they had a diagnosis of acute cervical SCI.	early and medium groups was observed. 4. More patients in the early (84.78%) and medium (81.58%) groups successfully weaned from MV than late group (65.00%).
Wang et al. 2020 China Case control Level 3 N = 45	**Population:** 45 patients with acute cervical SCI who underwent tracheostomy and cervical internal fixation; 31 males and 13 females; mean age of 50.02 years (ranging from 26 to 69 years); ASIA A (n = 24), ASIA B (n = 13), ASIA C (n = 7), and ASIA D (n = 1); and injury level C1-C2 (n = 5), C3-C5 (n = 35), and C6-C7 (n = 5). **Treatment:** Patients were retrospectively divided in two groups: • ET (immediately after spine fixation) (n = 25). • Delayed tracheotomy (3-12 days after fixation) (n = 20). **Outcome Measures:** Total duration of MV, duration of MV after tracheotomy, duration of	1. Compared with the delayed tracheotomy, the ET significantly reduced the total duration of MV (p = 0.001), duration of MV after tracheotomy (p = 0.011), duration of indwelling tracheal tube (p = 0.011), and hospital LOS (p = 0.001). 2. There were no significant differences in pneumonia rate (p = 0.161), mortality rate (p = 0.192) and total complications (p = 0.057) between groups.

	indwelling tracheal tube, hospital LOS, pneumonia, mortality, incision infection of anterior cervical spine internal fixation, and tracheotomy complications. **Chronicity:** Time since injury were not specified but patients were included if they had a diagnosis of acute cervical SCI.	
Beom & Seo 2018 Korea Case control Level 3 N = 48	**Population:** Mean age: 53.6 yr; Gender: male=43, female=5; Level of injury: N/R; Severity of injury: Mean ASIA impairment scale score (tracheostomy)=14.1 points, mean ASIA impairment scale score (non-tracheostomy)=23.4 points. **Intervention:** Patients either received an ET (within 7 days of initial SCI surgery) or a LT (after 7 days of initial SCI surgery) or no tracheostomy. **Outcome Measures:** Length of ventilation, ICU duration. **Chronicity:** Time since injury not specified, patients were treated on average 29 days after initial SCI surgical intervention.	1. There were no significant differences in the duration of post-operative ventilation between early vs. late tracheostomy patients. 2. The ET group had a significantly shorter LOS in the ICU than the LT group (p=0.03).
Flanagan et al. 2018 USA Case control Level 3 N = 70	**Population:** Mean age: 50.5 yr; Gender: male=53, female=17; Level of injury: C2=10, C3=12, C4=19, C5=9, C6=6, C7=2; Severity of injury: Mean ISS=19.6; **Intervention:** Patients either received an ET (<7 days) or late (>7 days) from their initial intubation. **Outcome Measures:** Ventilator days, tracheostomy days, ICU LOS, early pneumonia and surgical site	1. ET patients had fewer ventilator days compared to LT patients (p=0.028). 2. There was no significant difference in the number of days from tracheostomy to decannulation between early and LT patients. 3. Patients with ET had significantly fewer ICU stays (p=0.021). 4. There was no significant difference in the rates of early pneumonia and

	infections, in-hospital mortality, 90-day mortality, 90-day readmission. **Chronicity:** Patients are defined as being in the acute stage.	surgical site infections between the two groups, although both groups had high incidences. 5. There were no significant differences between groups in terms of in-hospital mortality, 90-day mortality, and 90-day readmission.
Kornblith et al. 2014 USA Case control Level 3 N = 344	**Population:** Mean age: 43 yr; Gender: male=275, female=69; Level of injury: cervical to lumbar; Severity of injury: complete=69, incomplete=275. **Intervention:** Patients either had a tracheostomy or did not. Of those requiring a tracheostomy, patients either experienced an ET or a LT. In addition, patients were either mechanically ventilated at discharge or were not. **Outcome Measures:** The following retrospectively: instances of prolonged MV, VAP, ALI, acute respiratory distress syndrome (ARDS), duration in ICU, duration in hospital, number of ventilator-free days, extubation attempts, ISS. **Chronicity:** Time since injury not specified. Average number of hospital days=20.	1. Patients who received a tracheostomy had higher rates of VAP ($p<0.05$), higher rates of ALI ($p<0.01$), spent significantly more days in ICU ($p<0.05$) and hospital ($p<0.05$), and had fewer ventilator-free days ($p<0.05$) compared to patients who did not receive a tracheostomy. 2. There were no significant differences with regards to death ($p>0.05$) between patients who received a tracheostomy and patients who did not. 3. Patients who had a LT had higher rates of VAP ($p<0.05$), ALI ($p<0.05$), and ARDS ($p<0.05$) compared to patients who had an ET. 4. Patients who required MV at discharge had a higher ISS ($p<0.05$), significantly higher rates of VAP ($p<0.05$) and ALI ($p<0.05$), and longer ICU ($p<0.05$) and hospital stays ($p<0.05$) compared to patients who did not require MV at discharge.
Choi et al. 2013 Korea Case control Level 3 N = 21	**Population:** Mean age: 50 yr; Gender: male=19, female=2; Level of injury: C1-C7; Severity of injury: complete=8, incomplete=13; AIS A-D.	1. Patients who received an earlier tracheostomy had a significantly shorter total ICU stay than patients who received a LT ($p=0.01$).

	Intervention: Patients either received an ET (≤10 days after injury) or a LT (>10 days after injury). **Outcome Measures:** The following retrospectively: duration of MV. **Chronicity:** Time since injury not specified. Average number of hospital days=78.	2. Patients who received an earlier tracheostomy experienced a significantly shorter duration of MV (p=0.009). 3. There were no significant differences with regards to pneumonia (p=0.283) or tracheal stenosis (p=0.999) between the two groups.
Babu et al. 2013 USA Case control Level 3 N = 20	**Population:** Mean age: 47 yr; Gender: male=18, female=2; Level of injury: cervical; Severity of injury: complete=11, incomplete=9; AIS A-E. Intervention: Patients either received an ET (≤6 days after anterior cervical spine fixation) or a LT (>6 days after anterior cervical spine fixation). **Outcome Measures**: The following retrospectively: length of hospital stay, incidence of complications, incidence and risk of complications. **Chronicity**: Time since injury not specified. The mean time from hospital presentation to anterior cervical spine fixation was 2.8 days. The mean length of hospital stay was 39 days.	1. Patients who underwent an ET had a shorter hospitalization stay compared to those who received a LT, but this difference was not significant (p=0.11). 2. One patient developed pneumonia after tracheostomy. Patients who received a LT were at a significantly increased risk for developing pulmonary complications (p=0.033).
Romero-Ganuza et al. 2011b Spain Case control Level 3 N = 323	**Population**: Mean age: 42 yr; Gender: male=255, female=68; Level of injury: cervical to thoracic; Severity of injury: complete=229, incomplete=94. **Intervention**: Patients either received a tracheostomy or did not. Of those who did, they either received ST or a percutaneous tracheostomy. They also either received an ET (≤7 days post intubation) or a LT (>7 days post intubation).	1. 92% (297/323) of patients required MV and 67% (215/323) required a tracheostomy. 2. Patients who received a tracheostomy had significantly higher injury levels (p<0.001) more severe injuries (p<0.001), more associated injuries (p=0.003), and higher APACHE II scores (p=0.03) than patients who did not require a tracheostomy.

	Outcome Measures: The following during hospital stay: incidence of MV and tracheostomy, injury level, injury severity, APACHE II scores, incidence of complications, duration of MV, duration of ICU stay. **Chronicity**: Mean interval from injury to admission=11.4 days.	3. There were 69 cases of perioperative complications following tracheostomy. Patients who received an ET had significantly fewer cases of tracheal stenosis than patients who received a LT (p=0.003). There were no significant differences in pneumonia (p=0.81), stomal cellulitis (p=0.45), bleeding (p=0.96), or mortality rate (p=0.22) between the two groups. 4. Patients who received an ET spent significantly fewer days on MV (p<0.001) and significantly fewer days in ICU (p<0.001) compared to patients who received a LT. 5. Patients who received a percutaneous tracheostomy spent significantly fewer days in ICU (p=0.004) and experienced fewer cases of pneumonia (p=0.011) compared to patients who received a ST.
Romero et al. 2009 Spain Case control Level 3 N = 152	**Population:** Mean age: 41 yr; Gender: male=122, female=30; Level of injury: cervical to thoracic; Severity of injury: complete=119, incomplete=33; AIS A-D. **Intervention:** Patients either received a tracheostomy early (≤7 days of admission) or late (>7 days of admission). **Outcome Measures:** The following retrospectively: total time of MV, time of MV post tracheostomy. **Chronicity:** Mean time interval between injury and admission=27 days.	1. Patients who received an ET had significantly fewer episodes of pneumonia during intubation than patients who received a LT (p<0.001). There were no significant differences in incidences of pneumonia post tracheostomy (p=0.80) and total incidences of pneumonia (p=0.27) between the two groups. 2. There were no differences in mortality between early vs. LT (p=0.12). 3. Patients who received an ET had significantly shorter post tracheostomy duration on MV (p<0.005) and total

		duration on MV (p<0.001) compared to patients who received a LT. 4. Patients who received an ET spent significantly fewer post tracheostomy days in ICU (p<0.05) and total days in ICU (p<0.0010) than patients who received a LT. 5. Patients who received an ET had significantly fewer total complications than patients who received a LT (p<0.05).
Binder et al. 2016 Austria Case series Level 4 N = 38	**Population:** 38 patients with cervical SCI who underwent anterior cervical spine fusion (ACSF); 32 males and 6 females; mean (SD) age 47 (± 20) years; upper cervical spine fractures (C1–4) (n = 15) and lower cervical spine fractures (C5–7) (n = 23); complete (n = 17) and incomplete (n = 22). **Treatment:** Tracheostomy. Two tracheostomies (5.3%) were performed simultaneously with the ACSF. The remaining 36 tracheostomies were performed after the ACSF, with an average "delay" of 15 ± 10 days. No neurological deterioration was observed after ACSF or tracheostomy. **Outcome Measures:** Initial and follow-ups neurological and clinical presentation (assessed according to the ASIA score and the Glasgow Coma Scale (GSC)); concomitant injuries related to CSI; severity of injuries (according to the ISS); X-ray follow-ups (6 and 12 weeks, and 12 and 24 months after discharge); and complications (infection, bleeding or	1. Tracheostomy: a. There was no difference in time to tracheostomy in patients presenting initially with an ASIA score of A, B, C or D. There was a tendency for earlier tracheostomy in patients with cervical spine fractures at the level of C4 or above when compared to patients with cervical spine fractures at the level of C5 or below. 2. Complications: a. Only 2 patients (5.3 %) exhibited infections at the site of anterior cervical fusion after placement of a tracheostomy. b. Another patient underwent revision surgery after three months, due to exhibiting oesophageal leakage. c. Six patients (15.8 %) died during their hospital stay because of multiple organ failure (n = 2), acute ischaemic stroke

	neurological deterioration were defined as major complications). **Chronicity:** Time since injury were not specified.	(n = 1) and cardiovascular failure (n = 3). d. There were no deaths directly related to airway difficulties, but 29 patients (76.3 %) exhibited culture- and X-ray-proven pneumonia, and 2 patients (5.3 %) developed ARDS.
Holscher et al. 2014 USA Retrospective chart review Level 3 N = 33	**Population:** N=91 SCI or TBI patients <18 years old who underwent tracheostomy (67M, 24F) Mean (SD) age: 13 (5) years 29 are ≤12 years old 62 are 13-18 years old **Treatment:** Early (≤7 days post-injury) vs. LT **Outcome Measures:** Number of ventilator days, ICU days, hospital days, number of patients who developed pneumonia and airway complications. **Chronicity:** Not specified.	1. Significantly reduced ventilator days, ICU days, hospital days for those younger than 13 who received ET, compared to those younger than 13 who received LT. 2. The same measures are not significantly different between groups in those who are 13 or older. 3. Significantly reduced prevalence of airway complications in those who received ET (all ages). 4. No significant between group difference in prevalence of pneumonia.
Luo et al. 2014 China Retrospective chart review Level 4 N = 21	**Population:** N=21 successfully decannulated patients with cervical SCI (17M, 4F) Mean (range) age: 44.57(12-68) years 10 tracheostomized <24h post injury 16 AIS-A, 5 AIS-B/C/D **Treatment:** Tracheostomy **Outcome Measures:** Time between tracheostomy to decannulation, time between closed tracheostomy to decannulation. **Chronicity:** Time since injury was not specified, but time to tracheostomy from injury	1. Mean duration* (range) of tracheostomy was 40 (14-104) days. 2. Mean duration* (SD) of closed tracheostomy was 18.8 (13.5) days. 3. No significant difference in mean duration of tracheostomy or closed tracheostomy between C2-C4 and C5-C7 patients with SCI, and between AIS-A and AIS-B/C/D patients. 4. Significantly shorter duration of tracheostomy in those ventilated for <10 days (compared to >10 days), and in those tracheostomized

	ranged from <24 hours to > 24 hours.	>24h post-injury (compared to <24h). *Until decannulation.