

| Author Year Country Research Design Score Total Sample Size | Methods | Outcome |
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| Dakson et al. (2017) Canada Case Control N=56 | <p>Population: Mean age: 47.6±20.7 yr; Gender: male=74, female=20; Level of injury: cervical=66, thoracolumbar=28; Severity of injury: AISA A=31, B=12, C=16, D=29, unknown=6.</p> <p>Intervention: No intervention. A retrospective review of individuals with SCI to determine the effect of early (<24 hr, n=23) or late (>24 hr, n=33) surgical decompression and maintenance of Mean Arterial Pressure (MAP) ≥85 mmHg for 5 days on neurological recovery.</p> <p>Outcome measures: American Spinal Injury Association (ASIA).</p> <p>Chronicity: The mean time from injury to surgical decompression was 13.4±5 hr and 127.7 hr for the early and late groups.</p> | <ol style="list-style-type: none"> 1. Individuals with MAP <85 mm Hg for at least two consecutive hr during the five-day period post injury were 11 times less likely to have an improvement in AIS grade when compared to individuals with MAP ≥85 mm Hg (p=0.006). This association was independent of early surgery or the severity of SCI. 2. At a mean of 252 days post injury, a significant proportion of individuals with SCI treated with early surgical decompression improved neurologically when compared to late decompression (p=0.031). |
| Bourassa-Moreau et al. (2016) Canada Case Control N=53 | <p>Population: Mean age: 42.4 yr; Gender: males=45, females=8; Level of injury: C1-C7=20, T1-L2=33; Level of severity:</p> <p>American Spinal Injury Association Impairment Scale (AIS) A ; Mean time since injury: 22.6 hr.</p> <p>Intervention: Individuals who underwent decompression surgery following SCI injury were retrospectively analyzed. Comparisons were made between early (<24 hr) and late (>24 hr) surgery as well as cervical (n=20) and thoracolumbar (n=33) injuries.</p> <p>Outcome Measures: Demographics, AIS.</p> | <ol style="list-style-type: none"> 1. Individuals operated <24 hr (n=38) were significantly younger than the 15 individuals operated >24 hr (p=0.049). 2. Overall, 28% (15/53) had improvement in AIS: 34% (13/38) who were operated <24 hr and 13% (2/15) who were operated >24 hr (p=0.182). 3. 64% (9/14) of cervical complete SCI operated <24 hr had improvement in AIS as opposed to none in the subgroup of six individuals with cervical SCI operated >24 hr (p=0.008). |
| Furlan et al. (2016) Canada Case Control N=61 | <p>Population: <i>Motor Complete Early (COME, n=12):</i> Mean age: 52.1 yr; Gender: males=11, females=1; Level of injury: C1-C4=4, C5-C8=8; Level of severity: AIS A=9, B=3. <i>Motor Complete Late (COML, n=14):</i> Mean age: 46.8 yr; Gender: males=12, females=2; Level of injury: C1-C4=10, C5-C8=4; Level of severity: AIS A=9, B=5. <i>Motor Incomplete Early (INE, n=11):</i> Mean age: 52.8 yr; Gender: males=7, females=4; Level of injury: C1-C4=4, C5-C8=7; Level of severity: AIS C=7, D=4. <i>Motor Incomplete Late (INI, n=24):</i> Mean age: 49.3 yr; Gender: males=15, females=9; Level of</p> | <ol style="list-style-type: none"> 1. Overall early spinal decompression is more cost effective than late spinal decompression. <ul style="list-style-type: none"> • For individuals with complete SCI injury, cost-effectiveness ratio analysis revealed a savings of US\$ 58,368,024.12 per quality adjusted life years gained. 2. For individuals with incomplete SCI injury, cost-effectiveness ratio analysis revealed a savings of US\$ 536,217.33 per quality adjusted life years gained. |

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| | <p>injury: C1-C4=12, C5-C8=12; Level of severity: AIS A=11, B=13.</p> <p>Intervention: individuals who underwent decompression surgery following cervical SCI injury were retrospectively analyzed. Comparisons were made between early (<24 hr) and late (≥24 hr) surgery as well as complete and incomplete injuries. Outcomes were assessed at baseline and 6 mo follow-up.</p> <p>Outcome Measures: Cost Effectiveness.</p> | |
| <p>Liu et al. (2015) China Case Control N_{Initial}=595, N_{Final}=489</p> | <p>Population: Early Decompression (ED, n=212): Mean age: 40.4 yr; Gender: males=166, females=46; Injury etiology: motor vehicle accident=121, fall=52, object hit=21, sports=18; Level of injury: C3=16, C4=53, C5=75, C6=43, C7=25; Level of severity: Frankel A=42, B=65, C=68, D=37; Time since injury range: <24 hr. Late Decompression (LG, n=383): Mean age: 41.9 yr; Gender: males=290, females=93; Injury etiology: motor vehicle accident=234, fall=102, object hit=26, sports=21; Level of injury: C3=26, C4=91, C5=141, C6=78, C7=47; Level of severity: Frankel A=82, B=132, C=123, D=46; Time since injury range: >24 hr.</p> <p>Intervention: Individuals who underwent surgical decompression after lower cervical (C3-C7) spine trauma were retrospectively reviewed and analyzed by timing of decompression surgery (ED versus LD). Outcomes were assessed at a mean follow-up time of 24.9 mo.</p> <p>Outcome Measures: Frankel Grade, Hospital Length of Stay (H-LOS), Neurological Deterioration, Mortality, Complications, Intensive Care Unit Length of Stay (ICU LOS), Ventilation (VENT) Days.</p> | <ol style="list-style-type: none"> Overall, 23 individuals died and 83 failed to receive a follow-up. 106 individuals (61.6%) in the ED group and 204 (64.4%) individuals in the LD groups experienced at least one Frankel grade (all p<0.001); however, there was no significant difference between groups (p=0.825). ED group individuals had significantly fewer H-LOS (p<0.001), greater post-op neurologic deterioration (p<0.001), and greater mortality (p=0.003). There was no significant difference between ED and LD groups in other complications (all p≥0.166), ICU LOS (p=0.150), or VENT days (p=0.056). |
| <p>Grassner et al. 2015 Germany Case Control N=70</p> | <p>Population: Early decompression (n=35): Mean age: 51.9±16.4 yr; Gender: male=26, female=9, Level of injury: not reported; Severity of injury: American Spinal Injury Association (ASIA) A=14, B=5, C=3, D=13, E=0.</p> | <ol style="list-style-type: none"> Individuals from the early decompression group had significantly increased AIS grades (p<0.006) and increased AIS conversion rate (p<0.029). No significant difference was observed in spinal cord compromise, sensory |

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| | <p>Late decompression (n=35): Mean age: 50.1±18.2 yr; Gender: male=33, female=2, Level of injury: not reported; Severity of injury: ASIA A=17, B=5, C=2, D=11, E=0.</p> <p>Intervention: A retrospective study examining functional and neurological outcomes at one yr post-surgical decompression in individuals with SCI who underwent surgery early (first 8 hr after injury) or late (>8 hr after injury).</p> <p>Outcome measures: American Spinal Injury Association (AISA) score; Spinal cord compromise; Neurological level; Sensory level; Motor level; Total motor score; Upper extremity motor score; Pin prick score; Light touch score; SCIM.</p> <p>Chronicity: The mean length of hospital stay was 127±58 days. The mean time from injury to surgical intervention was not reported.</p> | <p>level, pin prick or light touch score between groups.</p> <ol style="list-style-type: none"> 3. The motor and neurological levels of individuals who were operated on within eight hr were significantly more caudal after one yr ($p<0.003$ and $p<0.014$). 4. A significant increase in total motor performance ($p<0.025$) and upper extremity motor function ($p<0.002$) after one yr was observed in the early decompression group. 5. Individuals who were decompressed earlier had a significantly higher SCIM (45.8 vs 27.1, $p<0.005$). 6. A regression analysis showed that timing of decompression, age, basal AISA and SCIM scores were independent predictors of a better functional outcome. |
| <p>Bourassa-Moreau et al. (2013)a Canada Case Control N=431</p> | <p>Population: <i>Early Surgery (ES, n=90):</i> Mean age: 37.0 yr; Gender: males=74, females=16; Level of injury: C1-L2, paraplegic=61, tetraplegic=29; Level of severity: AIS A=55, B=16, C=8, D=11; Time since injury range: <24 hr. <i>Midrange Surgery (MS, n=231):</i> Mean age: 40.7 yr; Gender: males=181, females=50; Level of injury: C1-L2, paraplegic=130, tetraplegic=51; Level of severity: AIS A=109, B=42, C=38, D=42; Time since injury range: 24-72 hr. <i>Late Surgery (LS, n=110):</i> Mean age: 47.9 yr; Gender: males=80, females=30; Level of injury: C1-L2, paraplegic=36, tetraplegic=74; Level of severity: AIS A=33, B=13, C15, D=49; Time since injury range: >72 hr.</p> <p>Intervention: Participants who underwent surgery following SCI were retrospectively analyzed by timing of surgery.</p> <p>Outcome Measures: American Spinal Injury Association (ASIA) Grade, Complications.</p> | <ol style="list-style-type: none"> 1. Individuals who underwent decompression surgery earlier tended to be paraplegic and had a more severe ASIA grade. There were no differences in the other demographic and clinical variables with respect to surgical timing. 2. Individuals who had later surgery had significantly increased rates of pneumonia ($p=0.025$); no other complications were different between groups ($p>0.1$). 3. There was no significant difference in mortality rate between groups ($p=.393$). 4. ASIA grades A and B were significant predictors of all complications ($p\leq 0.05$). |
| <p>Bourassa-Moreau et al. (2013)b Canada Case Control</p> | <p>Population: <i>Early Surgery (ES, n=55):</i> Mean age: 36.4 yr; Gender: males=49, females=6; Level of injury: C1-C4=6, C5-T1=10, T2-T10=17, T11-S1=22; Level of severity: AIS</p> | <ol style="list-style-type: none"> 1. The cost of hospitalization was significantly lower for the ES group ($p<0.05$). 2. The total complication rate indicates that 57% of individuals had at least |

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| <p>N=197</p> | <p>A=55; Time since injury range: ≤24 hr. <i>Late Surgery (LS, n=142)</i>: Mean age: 40.4 yr; Gender: males=116, females=26; Level of injury: C1-C4=15, C5-T1=36, T2-T10=57, T11-S1=34; Level of severity: AIS A=142; Time since injury range: >24 hr.</p> <p>Intervention: Participants who underwent surgery following SCI were retrospectively analyzed by timing of surgery.</p> <p>Outcome Measures: Hospitalization Cost, Mortality, Complications.</p> | <p>one complication. The rate of total complications (p=0.01), pneumonia (p=0.04), and UTI (p=0.03) were significantly lower in individuals operated ≤24 hr after injury; the rate of PU was not statistically different between groups (p=0.255).</p> <ol style="list-style-type: none"> 3. There was no significant difference in mortality between groups (p=0.672). 4. Tetraplegia (p=0.006) and late surgery (p=0.01) were significant predictors of total complications. |
| <p>Fehlings et al. (2012) Canada Case Control N_{Initial}=313, N_{Final}=222</p> | <p>Population: Mean age: 47.4 yr; Gender: males=236, females=77; Level of injury: C1-C7; Injury etiology: motor vehicle accident=119, fall=121, assault=13, sports=3, other=3; Level of severity: AIS A=101, B=54, C=66, D=92; Mean time since injury: 14.2 hr (early surgery), 48.3 hr (late surgery).</p> <p>Intervention: Individuals who underwent decompression surgery following cervical SCI injury were retrospectively analyzed. Comparisons were made between early (<24 hr) and late (≥24 hr) surgery. Outcomes were assessed at baseline and 6 mo follow-up.</p> <p>Outcome Measures: American Spinal Injury Association Impairment Scale (AIS) Change, Complications.</p> | <ol style="list-style-type: none"> 1. At 6 mo post injury, 19.8% of individuals undergoing early surgery showed a greater than two grade improvement in AIS compared to 8.8% in the late decompression group (p=0.03). 2. At 6 mo post injury, there was no significant difference in number of individuals who improved by one AIS grade between early and late surgery groups (p=0.31). 3. Complications occurred in 24.2% of early surgery individuals and 30.5% of late surgery individuals (p=0.21). |
| <p>Wilson et al. (2012) Canada Case Control N=84</p> | <p>Population: <i>Early Decompression (ED, n=35)</i>: Mean age: 41.6 yr; Gender: males=29, females=6; Injury etiology: motor vehicle accident=13, fall=13, assault=1, other=8; Level of injury: C=14, T=12, L=9; Level of severity: AIS A=18, B=6, C=5, D=6; Time since injury range: <24 hr. <i>Late Decompression (LG, n=49)</i>: Mean age: 47.9 yr; Gender: male=38, female=11; Injury etiology: motor vehicle accident (n=10), fall (n=29), assault (n=3), other (n=7); Level of injury: C=30, T=9, L=10; Level of severity: AIS A=15, B=3, C=6, D=25; Time since injury range: >24 hr.</p> <p>Intervention: A group of individuals who underwent surgical decompression after spine trauma were retrospectively reviewed and analyzed by timing of decompression</p> | <ol style="list-style-type: none"> 1. Baseline assessment until acute hospital discharge: <ul style="list-style-type: none"> • Seven individuals (21.2%) in the ED group and nine individuals (18.4%) in the LD group experienced at least 1-Grade AIS improvement (p=0.47). • Three individuals (9.1%) in the ED group and one individual (2.0%) in the LD group experienced at least a 2-Grade AIS improvement (p=0.15). • The mean AMS improvement in the ED and LD groups were 6.2 and 9.7 points, respectively (p=0.18). 2. Baseline assessment until rehabilitation discharge: |

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| | <p>surgery (ED versus LD). Outcomes were assessed at baseline, acute discharge (mean: 24.8 days), and rehabilitation discharge (mean: 89.6 days)</p> <p>Outcome Measures: American Spinal Injury Association (ASIA) Motor Scale (AMS) Score, ASIA Impairment Scale (AIS).</p> | <ul style="list-style-type: none"> • Nine individuals (40.9%) in the ED group and 10 individuals (30.3%) in the LD group experienced at least 1-Grade AIS improvement (p=0.42). • Six individuals (27.2%) in the ED group and one individual (3.0%) in the LD group experienced at least a 2-Grade AIS improvement (p=0.01). • The mean AMS improvement in the ED and LD groups were 19.5 and 15.4 points, respectively (p=0.46). |
| <p>Mac-Thiong et al. (2012) Canada Cohort N=477</p> | <p>Population: Mean age: 41.4 yr; Gender: males=374, females=103; Level of injury: C=228, T/L=249; Level of severity: AIS A=205, B=73, C=68, D=131.</p> <p>Intervention: Participants who received early surgical stabilization and/or decompression (<24 hr; n=93) were compared to those who received late surgery (>24 hr; n=384).</p> <p>Outcome Measures: Length of Stay; Hospitalization cost.</p> | <ol style="list-style-type: none"> 1. Rates of complete injury (58% versus 39%, p=0.001) and thoracic/lumbar injury (66% versus 49%, p=0.004) were significantly higher in the early than late surgery group. 2. Mean length of stay was significantly shorter with early than late surgery (28.1d versus 36.7d, p<0.001). 3. Mean hospitalization cost was significantly lower with early than late surgery (\$20,525 versus \$25,036, p<0.0001). 4. In a dichotomized model (early versus late), timing of surgery was significantly associated with stay (p=0.04) and cost (p=0.003). 5. In continuous model (time post injury), timing of surgery was significantly associated with cost (p=0.003) but not stay (p=0.32). 6. Stay and cost were significantly associated with older age, greater injury severity, and higher injury level. |
| <p>Rahimi-Movaghar (2005) Iran Case Series N=12</p> | <p>Population: Mean age: 26.0 yr; Gender: males=11, females=1; Injury etiology: motor vehicle accident=9, unknown=3; Level of injury: thoracic; Level of severity: Frankel A=12.</p> <p>Intervention: Individuals with SCI who underwent surgical decompression were retrospectively analyzed. Mean follow-up time was 43.75 mo.</p> <p>Outcome Measures: Frankel Grade.</p> | <ol style="list-style-type: none"> 1. One individual improved from Frankel Grade A to C and one individual improved from Frankel Grade A to B following surgery. 2. Ten individuals remained at Frankel Grade A following surgery. |
| <p>Mirza et al. (1999) USA</p> | <p>Population: Mean age: 32 yr; Gender: males=26, females=4; Level of injury: C2-C7;</p> | <ol style="list-style-type: none"> 1. Early surgery showed significant improvements from baseline in mean |

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| Case Control N=30 | <p>Level of severity: Frankel I=20, II=1, III=2, IV=7.</p> <p>Treatment: Participants who received early surgical stabilization and/or decompression (≤ 3 days; n=15) were compared to those who received late surgery (>3 days; n=15) in a retrospective review.</p> <p>Outcome Measures: American Spinal Injury Association Motor Score (AMS); Frankel Grade; Hospitalization periods; Complications.</p> | <p>AMS (39.2 to 77.1, $p=0.006$) and Frankel Grade (1.9 to 3.7, $p=0.0026$).</p> <ol style="list-style-type: none"> 2. Late surgery showed non-significant improvements from baseline in mean AMS (23.5 to 39.1, $p=0.14$) and Frankel Grade (1.8 to 2.1, $p=0.30$). 3. Mean postoperative scores were significantly greater with early surgery than late surgery for AMS (77.1 versus 39.1, $p=0.01$) and Frankel Grade (3.7 versus 2.1, $p=0.01$). 4. There was no significant difference between groups in length of surgery, mechanical ventilation, or time in ICU, but overall acute care stay was significantly greater for late than early surgery (37 versus 22 days, $p=0.036$). 5. There was no significant difference between groups in the number of minor ($p=0.24$), major ($p=0.12$), or total ($p=.05$) complications. |