Consensus on Science

Cervical spinal motion restriction was defined as the reduction or limitation of cervical spinal movement. This definition may not apply to certain countries or organizations. Spinal stabilization was defined as the physical maintenance of the spine in a neutral position prior to applying spinal motion restriction devices. This evaluation was limited to mechanical cervical immobilization devices accessible to first aid providers, including cervical collars and sandbags with tape, but did not include spine boards.

(Semi)rigid collar (I) vs no collar (C)

For the critical outcome of neurological injury we identified very low quality of evidence (downgraded for risk of bias and imprecision) from 1 non-randomized study (Lin, 2011, 1028) with 5138 motorcycle crash victims, showing no difference in neurological injury (no significant difference according to the paper, however we were unable to calculate the MD and CI, because the mean and SD of the intervention and control group were not reported)

For the critical outcome complications (intracranial pressure) we identified low quality of evidence from 5 non-randomized studies (Davies, 1996, 647; Hunt, 2001, 511; Mobbs, 2002, 389; Kolb, 1999, 135; Raphael, 1994, 437) with 107 patients in total, showing increased intracranial pressure (MD (mm Hg) 4.69 95% CI [1.95; 7.43]; MD (mm H2O) 20.48 95% CI [5.62; 35.33]). We also identified very low quality (downgraded for indirectness) of evidence from 1 non-randomized study (Stone, 2010, 100) with 42 healthy volunteers showing increased intracranial pressure (MD (Internal jugular vein cross-sectional area) 0.19 95% CI [0.05; 0.33])

For the critical outcome complications (tidal volume) we identified very low quality of evidence (downgraded for risk of bias and imprecision) from 1 non-randomized study (Dodd, 1995, 961) with 38 patients, showing no decrease in tidal volume (significant decrease according to the paper, however we were unable to calculate the CI because the SD of the intervention and control group not reported)

For the important outcome cervical spine movement we identified low quality of evidence from 1 non-randomized study (Treloar, 1997, 5) with 18 head-injured children showing no benefit in terms of limiting flexion (MD -2.20 95% CI [-7.75 to 3.35]). For the same outcome we also identified very low quality of evidence (downgraded for indirectness) from 13 non-randomized studies (Podolsky, 1983, 461; Tescher, 2007, 1120; Zhang, 2005, 264; Horodyski, 2011, 513; Conrad, 2010, 432; Del Rossi, 2004, 619; Rosen, 1992, 1189; Bednar, 2004, 251; Evans, 2013, S10; DiPaola, 2008, 273; Fischer, 1977, 109; Sandler, 1996, 1624; Hughes, 1998, 374) with 457 cadavers or healthy volunteers showing benefit in terms of limiting flexion, extension, lateral bending, axial rotation and flexion/extension (flexion: MD -12.50 95% CI [-13.13; -11.87]; extension: MD -0.91 95% CI [-1.18; -0.64]; lateral bending: MD -1.99 95% CI [-2.33; -1.65]; axial rotation: MD -4.73 95% CI [-5.16; -4.3]; flexion/extension: MD -19.13 95% CI [-19.89; -18.36]). Seven additional studies (Gavin, 2003, 527; Askins, 1997, 1193; Cline, 1985, 649;
Ben-Galim, 2010,447; Burl, 1991, 308; Hamilton, 1996, 553; Richter, 2001, 848) were not included in the final analysis, since data were lacking (mean and/or standard deviation of intervention and control group not reported).

For the important outcome patient comfort we identified very low quality evidence (downgraded for indirectness and imprecision) from 1 non-randomized study (Hamilton, 1996, 553) with 26 healthy volunteers, showing no decrease or increase in patient comfort (MD -0.20 95% CI [-0.93; 0.53]).

We did not identify any evidence to address the important outcomes of overall mortality, and pain, and the less important outcome of hospital length of stay.

**Soft collar (I) vs no collar (C)**
For the important outcome cervical spine movement we have identified very low quality of evidence (downgraded for indirectness) from 3 non-randomized studies (Podolsky, 1983, 461; Sandler, 1996, 1624; Bednar, 2004, 251) with 36 cadavers or healthy volunteers showing benefit in terms of limiting flexion and axial rotation (flexion: MD -3.04 95% CI [-5.64; -0.4]; axial rotation: MD -9.07 95% CI [-14.17; -3.96]). The same studies showed no benefit in terms of limiting extension, flexion/extension and lateral bending (extension: MD -1.63 95% CI [-4.75; 1.49]; flexion/extension: MD -8 95% CI [-21.88; 5.88]; lateral bending: MD -0.14 95% CI [-2.79; 2.52]).

We did not identify any evidence to address the critical outcomes of neurological injury and complications, the important outcomes of overall mortality, pain, and patient comfort, and the less important outcome of hospital length of stay.

**Sand bags and tape (I) vs no motion restriction (C)**
For the important outcome cervical spine movement we identified very low quality evidence (downgraded for indirectness) from 1 non-randomized study (Podolsky, 1983, 461) with 25 healthy volunteers showing benefit in terms of limiting flexion, extension, axial rotation and lateral bending (flexion: MD -35.60 95% CI [-38.69; -32.51]; extension: MD -6 95% CI [-9.53; -2.47]; axial rotation: MD -73.30 95% CI [-75.99; -70.61]; lateral bending: MD -19.40 95% CI [-21.62; -17.18])

We did not identify any evidence to address the critical outcomes of neurological injury and complications, the important outcomes of overall mortality, pain, and patient comfort, and the less important outcome of hospital length of stay.

**Treatment Recommendations**
We suggest against the use of cervical collars by first aid providers (weak recommendation, very low quality of evidence).

**Values and preferences statement:**
• Consistent with the First Aid principle of preventing further harm, the potential benefits of applying a cervical collar does not outweigh harms such as increased intracranial pressure and the consequences of unnecessary neck movement.
• We recognize that first aid providers might not be able to discriminate between high or low risk individuals.
• We recognize the potential value of manual stabilization in certain circumstances, but this was not evaluated in this review.

Knowledge Gaps
More evidence is needed on manual stabilization (using hands/knees to restrict motion), trauma patients in the pre-hospital setting, high risk versus low risk patients, other forms of physical cervical spinal stabilization, and implementation and education. A review of the adverse effects as a consequence of application of a cervical collar could be interesting in the future.