Table 1. Studies describing spinal cord dose and radiation myelopathy

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Paper | Number of patients | SBRT dose in Gy (range) /fractions (range) | Specified spinal cord contour | Spinal cord Dmax  EQD2 (Gy) (range) | Cumulative spinal cord Dmax EQD2 of all RT for reirradiated patients (Gy) | RM | Quality of evidence |
| Chang et al.[22](#_ENREF_22) (2012) | DN: 131 | Mean EQD2 50.7/NR | Thecal sac | Mean 48.68 +/- 29.97 | N/A | 0 | Very low |
|  | RI: 54 | Mean EQD2 51.1/NR | Thecal sac | Mean 46.19 +/- 35.21 | Mean 83.37 | 0 |
| Sahgal et al.[24](#_ENREF_24) (2009) | DN:14 | Median 24 (7-40)/3 (1-5) | Thecal sac | Median 28  (15-57) | N/A | 0 | Very low |
|  | RI: 25 | Median 24 (8 - 30)/3 (1-5) | Thecal sac | Median 18  (10-49) | Median 41.5† | 0 |
| Sahgal et al.[9](#_ENREF_9) (2012) | RI:  non-RM 13 | Median 24 (10-30)/3 (1–5) | Thecal sac | Median 12.5  (1.9-58.7) | Mean 62.3  (50.3-74.3) | 0 | Low |
|  | RI:  RM 5 | Median 20 (16-33)/2 (1-3) | Thecal sac | Median 20.3  (12.3-32.6) | Mean 105.8  (84.3-127.4) | 5 |
| Sahgal et al.[8](#_ENREF_8) (2013) | DN:  non-RM 66 | NR/(1-5) | Thecal sac | Median 35.69 | N/A | 0 | Low |
|  | DN:  RM 9 | NR/(1-5) | Thecal sac | Median 73.69 | N/A | 9 |
| Thibault et al.[25](#_ENREF_25) (2015) | RI: 16 | Median 30 (20-35)/4 (2-5) | Cord PRV (+1.5mm) | Median 21.9  (12.4-25.0) | Median 51.3 | 0 | Very low |
|  | RI: 24 | Median 30 (24-35)/4 (2-5) | Cord PRV (+1.5mm) | Median 21.9  (17.5-26.7) | Median 73.9 | 0 |
| Yamada et al.[26](#_ENREF_26) (2008) | DN: 93 | Median 24 (18-24)/1 | Cord | Median 39.88  (1.74-56) | N/A | 0 | Very low |
| Katsoulakis et al.[27](#_ENREF_27)(2013) | RI: 8 | Median 9.9 (4.2-13.5)/5 | Cord | Median 9.9 (3.0-15.9) | 67.3 (51.9-90.8) | 0 | Very low |

SBRT = stereotactic body radiotherapy, EQD2 = equivalent dose in 2 Gy fractions, Dmax = maximum dose, DN = de novo SBRT, RI = re-irradiation SBRT, RM = radiation myelopathy cohort, NR = not reported, † = cumulative EQD2 estimated using summary data presented in paper, PRV = planning organ at risk volume, N/A = not applicable

Table 2. Recommended thecal sac Dmax constraints for de novo and reirradiation spinal SBRT

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Pre-SBRT |  | Recommended thecal sac Dmax for 1-5 fraction SBRT | | | | |
| Dose / fractions | (EQD2) | 1 fraction | 2 fractions | 3 fractions | 4 fractions | 5 fractions |
| De novo SBRT\* | (0 Gy) | 12.4 Gy | 17 Gy | 20.3 Gy | 23 Gy | 25.3 Gy |
| 20Gy/5† | (30 Gy) | 9 Gy | 12.2 Gy | 14.5 Gy | 16.2 Gy | 18 Gy |
| 30Gy/10† | (37.5 Gy) | 9 Gy | 12.2 Gy | 14.5 Gy | 16.2 Gy | 19 Gy |
| 40Gy/20† | (40 Gy) | N/A | 12.2 Gy | 14.5 Gy | 16.2 Gy | 20 Gy |
| 45Gy/25† | (43 Gy) | N/A | 12.2 Gy | 14.5 Gy | 16.2 Gy | 21 Gy |
| 50Gy/25† | (50 Gy) | N/A | 11 Gy | 12.5 Gy | 14 Gy | 15.5 Gy |

SBRT = stereotactic body radiotherapy, EQD2 = equivalent dose in 2 Gy fractions, Dmax = maximum dose, \* = values taken from Sahgal et al. 2013[8](#_ENREF_8), † = values taken from Sahgal et al. 2012[9](#_ENREF_9)

Table 3. Studies describing the risks of vertebral compression fracture (VCF) following SBRT

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Paper | | Patients/ spinal segments | SBRT dose (Gy) (range) / fractions (range) | VCF Incidence (%) | Time to VCF in months (range) | Predictive factors for VCF on multivariate analysis | Salvage interventions in those developing VCF (%) | Quality of evidence |
| Sahgal et al.[10](#_ENREF_10)\* (2013) | | 252/410 | 12-19/1  (1-5) | 13.9 | Median 2.46  (0.03 - 43.01) | Dose per fraction ≥20 Gy, baseline VCF, lytic tumor, spinal misalignment | 42 | Very low |
| Cunha et al.[28](#_ENREF_28)\* (2012) | | 90/167 | 20-27 (8-35)/ 3 (1-5) | 11.4 | Median 2 | Scoliosis/kyphosis, lytic tumor, dose per fraction ≥20 Gy, lung/liver histology | 47 | Very low |
| Thibault et al.[29](#_ENREF_29) (2014) | | 37/71 | 20-24 (18-30)/2 (1-5) | 14.1 | Median 1.58 | Single fraction, presence of baseline VCF | 40 | Very low |
| Boehling et al.[30](#_ENREF_30)\* (2012) | | 93/123 | Median 27/3 (1-5) | 20.3 | Median 3 | Age > 55yo, pre-existing fracture, baseline pain, (obesity was a protective factor) | 40 | Very low |
| Garg et al.[31](#_ENREF_31)\* (2012) | | 61/63 | 16-24/1 | 20.6 | NR | NR | NR | Very low |
| Sellin et al.[32](#_ENREF_32)\* (2015) | | 37/40 | Median 24 (24-30)/1  (1-5) | 32.5 | NR | NR | NR | Very low |
| Lee et al.[33](#_ENREF_33) (2016) | | 79/79 | 24-27 (16-27)  /3 (1-3) | 40.5 | Mean 3.3 (0.4-34.1) | NR | 47 | Very low |
| Balagamwala et al.[34](#_ENREF_34) (2013) | | 348/507 | Median 15 (7-18)/1 | 15 | NR | Pre-existing VCF, pain | NR | Very low |
| Yamada et al.[26](#_ENREF_26)\* (2008) | | 93/108 | Median 24 (18-24)/1 | 1.9 | NR | NR | NR | Very low |
| Rose et al.[12](#_ENREF_12)\* (2009) | | 62/71 | Median 24/1 | 38 | Median 25 | Lytic tumors, proportion of vertebral body occupied by tumor 41-60% | 11 | Very low |
| Moussazadeh et al.[35](#_ENREF_35)\* (2015) | | 31/36 | Median 24/1 | 36.1 | Median 25.7 (11.6-76.0) |  | 38 | Very low |
| Amdur et al.[36](#_ENREF_36) (2009) | | 21/25 | Median 15/1 | 12 | NR | NR | 33 | Very low |
| Ahmed et al.[37](#_ENREF_37) (2012) | | 66/85 | Median 24 (10-40)  /3 (1-5) | 1.2 | NR | NR | 100 | Very low |
| Gagnon et al.[38](#_ENREF_38) (2009) | | 200/274 | Median 26.4/3 | 0.7 | NR | NR | 100 | Very low |
| Germano et al.[39](#_ENREF_39) (2015) | | 79/143 | Median 18 (10-18)/1 | 21 | Median 5 (3-24) | NR | 30 | Very low |
| Chang et al.[22](#_ENREF_22)\* (2012) | | 142/185 | EQD2=51/NR | 6.5 | NR | NR | 42 | Very low |
| Chang et al.[40](#_ENREF_40)\* (2014) | | 27 / 39 | Mean 28.7 / (1-5) | 12.8 | NR | NR | 40 | Very low |
| Sung et al.[41](#_ENREF_41) (2014) | | 72/72 | Mean SFED 21/(1-5) | 36.1 | Mean 1.5 | Vertebral body osteolysis rate | 58 | Very low |
| Lee et al.[42](#_ENREF_42) (2013) | | 36/51 | 27/3 | 9.8 | Median 4.2 | NR | 60 | Very low |
| Kim et al.[43](#_ENREF_43) (2013) | 22/31 | Median 24 (16-30)  /3 (1-5) | 16.1 | NR | NR | NR | Very low |
| Bate et al.[44](#_ENREF_44) (2015) | NR / 48 | 22 (16-30) / 1 (1-5) | 10.4 | NR | NR | NR | Very low |
| Sohn et al.[45](#_ENREF_45) (2014) | 13 / 17 | Mean 38 / mean 4 | 11.8 | NR | NR | 0 | Very low |
| Lee et al.[46](#_ENREF_46) (2012) | 57 / 73 | 24 / 3 | 4.1 | NR | NR | NR | Very low |
| Martin et al.[47](#_ENREF_47) (2012) | 41 / 53 | (8-30) / (1-3) | 1.9 | NR | NR | 100 | Very low |

SBRT = stereotactic body radiotherapy, VCF = vertebral compression fracture, NR = not reported, SFED = single fraction equivalent dose, \* = study not included in the calculation of mean incidence of VCF due to possible overlap with other studies, N/A = not applicable

Table 4. Studies describing the risks of epidural disease progression

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Paper | Patients | Dose (Gy) (range) / fractions (range) | Postop (%) | % of patients with high-grade epidural disease prior to SBRT (including postop) | % of patients with 1year local control | % of failures in epidural space | Predictors of local failure | Quality of evidence |
| Massicotte  et al.[48](#_ENREF_48)\* (2012) | 10 | Median 24 (18-35)/  3 (1-5) | 100 | 0 | 70 | 67 | NR | Very low |
| Al-Omair  et al.[21](#_ENREF_21)\* (2013) | 80 | Median 24 (18-40)/  2 (1-5) | 100 | 10 | 84 | 71 | Postoperative Bilsky 2 or 3, 18-40Gy/3-5 fractions | Very low |
| Thibault  et al.[29](#_ENREF_29)\* (2014) | 37 | Median 24 (18-30)/  2 (1-5) | 14 | 10 | 83 | 66 | NR | Very low |
| Thibault  et al.[25](#_ENREF_25)\* (2015) | 40 | Median 30 (20-35)/  4 (1-5) | 66 | 5 | 81 | 85 | Paraspinal soft tissue extension | Very low |
| Chan et al.[23](#_ENREF_23) (2016) | 70 | (18-40)/(1-5) | 100 | 8 | 80 | 96 | NR | Very low |
| Chang et al.[49](#_ENREF_49)\* (2007) | 63 | Median 30 (27-30)/  5 (3-5) | 24 | NR | 84 | 47 | NR | Very low |
| Nguyen et al.[50](#_ENREF_50)\* (2010) | 48 | Median 30 (24-30)/  5 (1-5) | 51 | NR | Spinal PFS 82 | 50 | NR | Very low |
| Garg et al.[51](#_ENREF_51) (2011) | 59 | Median 27 (27-30)/  3 (3-5) | 32 | NR | 76 | 38 | 5 of 6 patients who developed MESCC had tumors that were initially within 5mm of the cord | Very low |
| Balagamwala et al.[52](#_ENREF_52)\* (2012) | 57 | Median 15 (8-16)/ 1 | 27 | NR | PFS 71 | 80 | Multilevel spinal disease, neural foramen involvement | Very low |
| Choi et al.[19](#_ENREF_19) (2010) | 42 | Median 20 (10-30)/  2 (1-5) | 0 | NR | 73 | 38 | Time to retreatment ≤ 12 months and single session equivalent dose < 15Gy | Very low |
| Nelson et al.[53](#_ENREF_53) (2009) | 32 | Median 18 (14-30)/  3 (1-4) | 0 | NR | 88 | 50 | NR | Very low |

SBRT = stereotactic body radiotherapy, EQD2 = equivalent dose in 2 Gy fractions, NR = not reported, PFS = progression-free survival, \* = study not included in the calculations of mean local failure and epidural failure due to possible overlap with other studies, † = freedom from marginal recurrence, MESCC = metastatic epidural spinal cord compression, GTV = gross tumor volume, BED = biologically effective dose