Prostate: RTOG 0504 / SPPORT (bed), RTOG 01415 (intact), RTOG 0815 (intact).

Rectal: RTOG 0822. Anal: RTOG 0529.

Gyn: RTOG 0418, TIME-C / RTOG 1203, RTOG 0724.

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| **Pelvis** | **[Conventional]** |  |
| **Colon / Large bowel** | 60 Gy  Anal:  30 Gy (200 cc) 05-29  35 Gy (150 cc) 05-29  45 Gy (20 cc) 05-29 |  |
| **Rectum** | **75 Gy (15%)** (20%) 04-15, PACE (74 Gy)  **70 Gy (20%)** (25 - 30%) 04-15, PACE  **65 Gy (25%)** (35 - 40%) 04-15, 08-15, 05-34  69.5 Gy EQD2 (2 cc)Mazeron RTO ’16  **65 Gy** EQD2 **(2 cc)**Kircheiner RTO ’16  55 Gy EQD2 (11 cc)Ujaimi BT ’17  60 Gy (50 - 55%) 04-15, 08-15  50 Gy (50%) PACE, QUANTEC  45 Gy (60%) 07-24  40 Gy (55 - 60%) 05-34 (SPPORT)  40 Gy (80% - 100%) TIME-C / 04-18  30 Gy (60%) 04-18 | Late G3+ and G2+ of < 10% and < 15% for the following constraints: QUANTEC   * V75 < 15%. *Add 10% for bladder (V75 < 25%).* * V70 < 20%. *Add 15% for bladder (V70 < 35%).* * V65 < 25%. *Add 25% for bladder (V65 < 50%).* * V60 < 35%. * V50 < 50%.   TL; DR - V65-V75 and their corresponding numbers all add up to 90% for the rectum - the “rectal Rule of 90s”. One hundred minus 90 is 10%, which is the rate of late G3+ rectal toxicity with these values.  Maintain rectal V70 < 20-25% to mitigate the risk of “bowel bother”, although this “bowel bother” would be unlikely to affect your patients golf game (PROST\_QA) [Hamstra IJROBP ’13]. RoR |
| **Bladder** | 80 Gy (2 cc)Jensen RTO ‘17  80 Gy (15 - 20%) 04-15, 08-15  **75 Gy (25%)** (30%) 04-15, 08-15  **70 Gy (35%)** (40%) 04-15, 08-15  **65 Gy (50%)** (55%) 04-15, 08-15, 05-34  50 Gy (50%) CHHiP, PACE  45 Gy (35%) TIME-C / 04-18 / 07-24  **40 Gy (70% -** 77.5%)05-34 (SPPORT)  Rectal:  40 Gy (40%) 08-22  45 Gy (15%) 08-22  50 Gy 08-22  Anal:  35 Gy (50%) 05-29  40 Gy (35%) 05-29  50 Gy (5%) 05-29 | Whole bladder 50 Gy = 5-10% late G3-4 effects.QUANTEC  Whole bladder 60 Gy = 10-40% late G3-4 effects.QUANTEC  Dmax < 65 Gy with late G3+ toxicity ≤ 6% (bladder cancer). QUANTEC  Minimize late G3+ toxicity with the following constraints:   * V80 < 15% * **V75 < 25%**. *Subtract 10% for rectum (V75 < 15%).* * **V70 < 35%**. *Subtract 15% for rectum (V70 < 20%).* * **V65 < 50%**. *Subtract 25% for rectum (V65 < 25%).*   TL; DR - know the “rule of 90s” for the V75-65 of the rectum, then add 10%, 15%, and 25% in descending order. There is no low single digit bladder toxicity with these values.  RTOG 05-34 / SPPORT allows variation acceptable if no bladder constraints are met.  Of note, SPPORT and other prostate bed trials subtract CTV from the bladder. |
| **Ureter / Urethra** | 70 Gy | Urethra: < 70 Gy with < 5% risk of stricture. |
| **Penile bulb** | Mean < 52.5 Gy 04-15, 08-15  70 Gy (60-70%)  50 Gy (90-95%)  Mean < 24 Gy CHHiP | Mean dose < 52.5 Gy and limiting 90% of the prostate to 50% has a < 35% incidence of severe ED. QUANTEC  Limiting 60-70% of the penile bulb has a < 55% incidence of severe ED. QUANTEC |
| **Vagina** | Upper < 120-150 Gy  Mid < 80-90 Gy  Lower < 60-70 Gy | Vaginal doses >50-60 Gy can cause significant fibrosis.  G2+ vaginal stenosis for 65 / 75 / 85 Gy of 20→ 27→ 34% [Kirchheiner RTO ’16] |
| **Femoral heads** | Mean < 45 Gy  Rectal:  40 Gy (40%) 08-22  45 Gy (25%) 08-22  50 Gy 08-22  Anal:  **30 Gy (50%)**05-29  40 Gy (35%) 05-29  44 Gy (5%) 05-29 |  |
| **Iliac crest** | **30 Gy (50%)**05-29  40 Gy (35%) 05-29  50 Gy (5%)05-29 |  |
| **Bone marrow**  (Cervical cancer) | **Median < 34.2 Gy** Klopp IJROBP ’16  **40 Gy (37%)**TIME-C / 04-18, Klopp IJROBP ’16  20 Gy (75%) Mell IJROBP ’06  **10 Gy (90%)**TIME-C / 04-18, Mell IJROBP ’06 | Cervical cancer (weekly cisplatin):  G2+ heme for BM V40 ± 37% or median BM ± 34.2 Gy of 40→ 75% [Klopp IJROBP ’16]. *V20 and V10 did not pan out.*  G2+ neutropenia for BM V10 ± 90% of 11→ 74% and BM V20 ± 75% of 14→ 25% [Mell IJROBP ’06]. *V40 did not pan out.* |
| **Bone marrow**  (Anal cancer) | 30 Gy (750 cc) Lee IJROBP ’17  40 Gy (23%) Lee IJROBP ’17 | Anal cancer (MMC): It makes sense that V40 is a lower value than for cervical cancer, as MMC has significant heme toxicity.  Patients who had ≥ 750 cc spared from ≥ 30 Gy had 0% G3 heme at week 3.  G3+ neutropenia for BM V40 ± 23% of 8→ 33%. |
| **External genitalia** | 20 Gy (50%) 05-29  30 Gy (35%) 05-29  40 Gy (5%) 05-29 | Testicles: Permanent sterility > 6 Gy single dose or 3 Gy fractionated.  Oligospermia 0.15 Gy (with 6w latency). Azoospermia 0.5 Gy. Recovery is dose-dependent (1y after 2 Gy).  Effective sterilizing dose at birth / 10y / 20y / 30y of 20→ 18→ 16→ 14 Gy [Skrzypek AAEM ’19]. |
| **Gluteal folds** | < 36 Gy if possible |  |
| **Skin (0.5 cm rind)** | Minimize dose, 20 Gy |  |