Purpose:To present a new technique to plan and deliver spatially-fractionated radiotherapy (GRID) utilizing helical TomoTherapy IGRT system.

Methods:In a single large dose (20 Gy), GRID offers an effective radiation therapy for bulky malignant tumors. The conventional GRID irradiation is delivered through a dedicated grid block or field intensity modulation using a multileaf collimator (MLC). However, the dose to nearby organs-at-risk (OAR) becomes a concern when treating deep seated bulky lesions in GRID technique. So With its capability of delivering highly conformal and multifocal dose distributions, TomoTherapy emerges as a promising radiotherapy modality for GRID therapy that delivers high single dose to deep seated tumors with excellent normal tissue sparing. It is called TOMO GRID. Planning CT images and contours are exported from a Pinnacle3 planning workstation via DICOM connection to the in-house developed software system, DICOMan, where Boolean operations are applied to GTV contours to create multiple parallel GRID targets. An avoidance (GTV - GRID targets) structure is also created to help the inverse planning process to achieve the desired peak-valley ratio. Those CT images and contours will be repackaged in DICOMan and sent to TomoTherapy planning workstation.

Results:TOMO GRID delivers highly non-uniform dose distributions that resemble more or less those of breachytherapy. The TOMO GRID targets (virtual implants) can be configured in various patterns (templates), sectional shapes and sizes. At each “insert” position, the implant can be in either “needle” or “seed-spacer” train. Tested in both phantom and real patient datasets, our results show that it is feasible to deliver GRID therapy on TomoTherapy unit for deep seated lesions.

Conclusions:TomoTherapy has a great potential to deliver GRID therapy with a superior quality than conventional GRID therapy. More studies need to be conducted to justify the applicability of this technology in clinics.