Comparing VMAT and AP/PA techniques for TBI: plan quality, delivery efficiency, and lung dose rate

B. Guo, A Magnelli and P. Xia
Taussig Cancer Institute, Cleveland Clinic, Cleveland, OH

JULY 12–16 2020 VIRTUAL
JOINT AAPM | COMP MEETING
EASTERN TIME [GMT-4]

ABSTRACT

Purpose: To develop a VMAT planning workflow for TBI and compare the plan quality, delivery time and lung dose rate with the conventional AP/PA technique.

Method and Materials: The Visible Human Male dataset was used for TBI planning to prescribe 13.2 Gy in 8 fractions. The conventional AP/PA TBI was planned using manual MU calculation with 10 MV beams at 400 cm SAD using spoiler, lung and kidney blocks. The plan was recreated in the treatment planning system to calculate 3D dose. The VMAT TBI plan was created using 17 beams with 6 isocenters in the head first supine position and 3 isocenters in the feet first supine position. Both techniques aimed to deliver uniform dose to the whole body and reduce lung and kidney dose to <10 Gy. DVHs to the PTV (whole body – lungs and kidneys), lungs, kidneys, as well as the instantaneous delivery dose rate to the lungs were comared between the two techniques.

Results: When compared with AP/PA technique, VMAT improved dose uniformity in the PTV and reduced dose to normal structures. V90 of the PTV increased from 93.5% to 98.6% while V110 decreased from 59.2% to 14.4%. The mean lung dose decreased from 12.6 Gy to 9.3 Gy and the kidney mean dose decrease from 10.6 Gy to 9.8 Gy. The estimated beam-on time was 16.5 min for VMAT vs 14.5 min for AP/PA. The instantaneous dose rate to lungs ranged from 0 to 210 cGy/min for VMAT. If using beam dose rate of 100 MU/min, the lung dose rate can be reduced to < 15 cGy/min during 95% of beam-on time at the cost of increased beam-on time of 24.5 min.

Conclusion: Using VMAT for TBI improves dose uniformity and normal tissue sparing. Beam-on time is comparable between VMAT and AP/PA technique.

KEY RESULTS

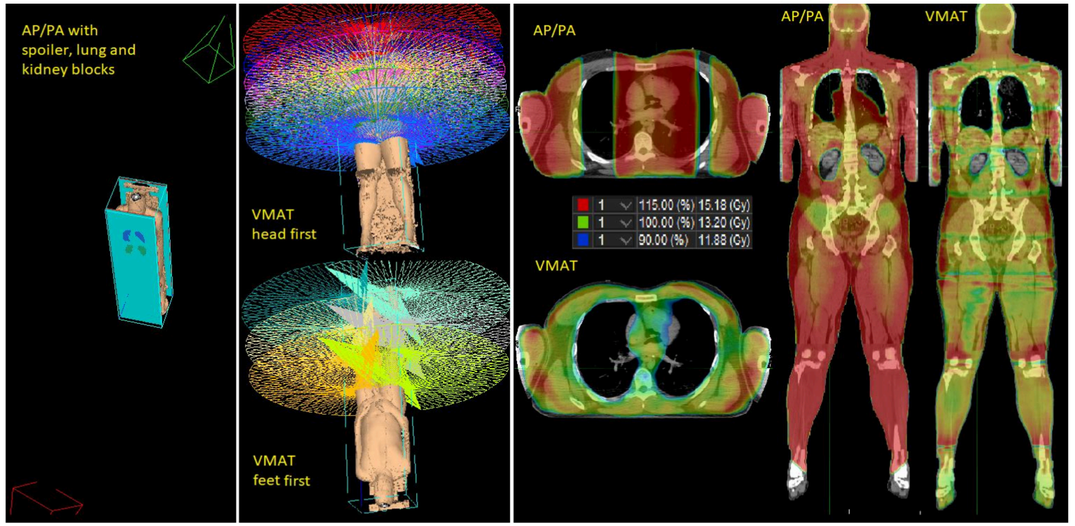
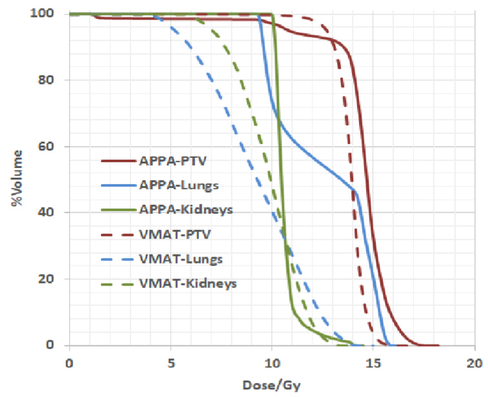


Figure 1. Comparing beam configurations and dose distributions between AP/PA and VMAT techniques



	AP/PA	VMAT
PTV V90/%	93.5	98.6
PTV V100/%	91.6	90.0
PTV V110/%	59.2	14.4
Lungs Dmean/Gy	12.6	9.3
Kidneys Dmean/Gy	10.6	9.8

Figure 2. DVH comparison between AP/PA and VMAT TBI

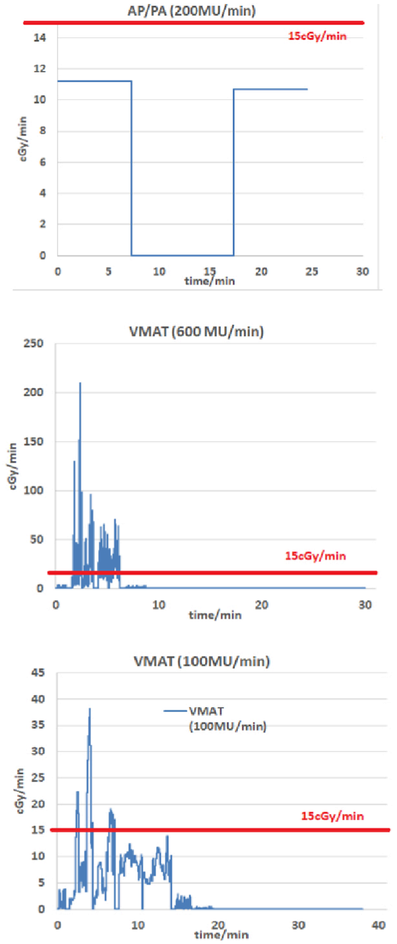


Figure 3 Dose rate to lungs during AP/PA and VMAT delivery

CONTACT INFORMATION

guob@ccf.org