From Anisotropic Analitical Algorithm to Acuros XB: Clinical implications in VMAT planning for lung, head&neck and prostate treatments

Aparicio A., Conles I., Cenizo E., Cesteros MJ. Complejo Asistencial Universitario de León, León, Spain

PURPOSE:
To determine the dose differences and clinical implications of using a high accuracy algorithm, Acuros XB (AXB) instead of the Anisotropic Analitical Algorithm (AAA), for three different treatment sites with VMAT technique, in order to use AXB as routine algorithm.

METHODS:
Representative samples of patients have been chosen (15 for prostate and head &neck sites and 17 for lung cases). All of them had been optimized and calculated with AAA. These plans were recalculated with AXB and dose differences were evaluated in several representative dose-volume points (those that could lead to clinical consequences both for the PTV and for the OAR involved). All data were statistically treated in order to obtain correct and applicable conclusions to all patients.

For PTV, clinical consequences in terms of coverage and homogeneity were derived.

For OAR, taking into account that classic dose tolerances have been stated based on AAA or even simpler algorithms, we focused on those dose-volume points in which AXB algorithm offers statistically significant lower calculated doses than AAA.

RESULTS:
PTV: For lung and head & neck patients, due to the high heterogeneity involved, it is observed a worse coverage and homogeniety in plans recalculated with AXB. Consequently, if AXB is used in routine clinical practice, a more demanding optimization is needed to meet objectives, leading to better local control of the disease. For prostate sites, no clinically relevant differences have been obtained concerning to PTV.

OAR: In those DVH points where statistically significant dose differences have been found, an additional restriction (AR) for the OAR tolerance criteria is proposed: AR= Mean(%)+3σM

Analysis of DVH points:
Coverage for PTV: Dmean, D2%, D5%, D95%, V95%, V100%, V120%
Organs at Risk (OAR): Dmax, Dmean, V30%, V40%, V60%, depending on OAR type (see tables below)

CONCLUSIONS:
For most of the points studied, the results obtained with AXB differ from those obtained with AAA. Since AXB has been proven to be more accurate, we propose to use it in clinical practice.

Nevertheless, we strongly recommend being cautious about OAR tolerances, setting an additional restriction to the tolerance criteria when required, at least until these have been reviewed and an international consensus is adopted taking into account the new algorithms

Methods: Representative samples of patients have been chosen (15 for prostate and head & neck sites and 17 for lung cases). All of them had been optimized and calculated with AAA. These plans were recalculated with AXB and dose differences were evaluated in several representative dose-volume points (those that could lead to clinical consequences both for the PTV and for the OAR involved). All data were statistically treated in order to obtain correct and applicable conclusions to all patients.

For PTV, clinical consequences in terms of coverage and homogeneity were derived.

For OAR, taking into account that classic dose tolerances have been stated based on AAA or even simpler algorithms, we focused on those dose-volume points in which AXB algorithm offers statistically significant lower calculated doses than AAA.

Results:
PTV: For lung and head & neck patients, due to the high heterogeneity involved, it is observed a worse coverage and homogeniety in plans recalculated with AXB. Consequently, if AXB is used in routine clinical practice, a more demanding optimization is needed to meet objectives, leading to better local control of the disease. For prostate sites, no clinically relevant differences have been obtained concerning to PTV.

OAR: In those DVH points where statistically significant dose differences have been found, an additional restriction (AR) for the OAR tolerance criteria is proposed: AR= Mean(%)+3σM

Conclusions:
For most of the points studied, the results obtained with AXB differ from those obtained with AAA. Since AXB has been proven to be more accurate, we propose to use it in clinical practice.

Nevertheless, we strongly recommend being cautious about OAR tolerances, setting an additional restriction to the tolerance criteria when required, at least until these have been reviewed and an international consensus is adopted taking into account the new algorithms.

Methods: Representative samples of patients have been chosen (15 for prostate and head & neck sites and 17 for lung cases). All of them had been optimized and calculated with AAA. These plans were recalculated with AXB and dose differences were evaluated in several representative dose-volume points (those that could lead to clinical consequences both for the PTV and for the OAR involved). All data were statistically treated in order to obtain correct and applicable conclusions to all patients.

For PTV, clinical consequences in terms of coverage and homogeneity were derived.

For OAR, taking into account that classic dose tolerances have been stated based on AAA or even simpler algorithms, we focused on those dose-volume points in which AXB algorithm offers statistically significant lower calculated doses than AAA.

Results:
PTV: For lung and head & neck patients, due to the high heterogeneity involved, it is observed a worse coverage and homogeniety in plans recalculated with AXB. Consequently, if AXB is used in routine clinical practice, a more demanding optimization is needed to meet objectives, leading to better local control of the disease. For prostate sites, no clinically relevant differences have been obtained concerning to PTV.

OAR: In those DVH points where statistically significant dose differences have been found, an additional restriction (AR) for the OAR tolerance criteria is proposed: AR= Mean(%)+3σM

Conclusions:
For most of the points studied, the results obtained with AXB differ from those obtained with AAA. Since AXB has been proven to be more accurate, we propose to use it in clinical practice.

Nevertheless, we strongly recommend being cautious about OAR tolerances, setting an additional restriction to the tolerance criteria when required, at least until these have been reviewed and an international consensus is adopted taking into account the new algorithms.

Methods: Representative samples of patients have been chosen (15 for prostate and head & neck sites and 17 for lung cases). All of them had been optimized and calculated with AAA. These plans were recalculated with AXB and dose differences were evaluated in several representative dose-volume points (those that could lead to clinical consequences both for the PTV and for the OAR involved). All data were statistically treated in order to obtain correct and applicable conclusions to all patients.

For PTV, clinical consequences in terms of coverage and homogeneity were derived.

For OAR, taking into account that classic dose tolerances have been stated based on AAA or even simpler algorithms, we focused on those dose-volume points in which AXB algorithm offers statistically significant lower calculated doses than AAA.

Results:
PTV: For lung and head & neck patients, due to the high heterogeneity involved, it is observed a worse coverage and homogeniety in plans recalculated with AXB. Consequently, if AXB is used in routine clinical practice, a more demanding optimization is needed to meet objectives, leading to better local control of the disease. For prostate sites, no clinically relevant differences have been obtained concerning to PTV.

OAR: In those DVH points where statistically significant dose differences have been found, an additional restriction (AR) for the OAR tolerance criteria is proposed: AR= Mean(%)+3σM

Conclusions:
For most of the points studied, the results obtained with AXB differ from those obtained with AAA. Since AXB has been proven to be more accurate, we propose to use it in clinical practice.

Nevertheless, we strongly recommend being cautious about OAR tolerances, setting an additional restriction to the tolerance criteria when required, at least until these have been reviewed and an international consensus is adopted taking into account the new algorithms.