Incidence of pelvic insufficiency fractures after external beam radiotherapy for gynecological cancers using post-treatment image follow-up: a meta-analysis of 3929 patients

L. Sapienza^{1,2}, M. Pontremoli Salcedo³, A. Jhingran⁴, V. Calsavara⁵, E. Carvalho⁶, M. Ning⁴, K. Schmeler⁷, M.J. Leite Gomes⁸, G. Baiocchi⁹.
¹Ascension Providence Hospital - Michigan State University College of Human Medicine, Internal Medicine, Southfield, USA.
²Baylor College of Medicine, Radiation Oncology, Houston, USA.
³Federal University of Health Sciences/Irmandade Santa Casa de Misericórdia de Porto Alegre, Obstetrics and Gynecology, Porto Alegre, Brazil.
⁴The University of Texas MD Anderson Cancer Center, Radiation Oncology, Houston, USA.
⁵A. C. Camargo Cancer Center, Epidemiology and Statistics, São Paulo, Brazil.
⁶Universidade do Estado do Rio de Janeiro - UERJ, Urology, Rio de Janeiro, Brazil.
⁷The University of Texas MD Anderson Cancer Center, Gynecologic Oncology & Reproductive Medicine, Houston, USA.
⁸Hospital Federal dos Servidores do Estado do Rio de Janeiro - HFSE-RJ, Radiation Oncology, Rio de Janeiro, Brazil.
⁹A. C. Camargo Cancer Center, Gynecologic Oncology, São Paulo, Brazil.

Purpose:
To estimate the overall rate, symptomatic proportion, and most common sites of pelvic insufficiency fracture (PIF) after external beam radiotherapy for gynecological cancer based on post-treatment CT, MRI, PET or bone scintigraphy.

Methods:
A systematic search of databases (PubMed and EMBASE) was performed (CRD42019125679). The pooled summary of overall PIF (detected by post treatment image follow-up) and the proportion of symptomatic cases were calculated by using the random-effects model weighted by the inverse variance.

Results:
A total of 702 articles were initially found, resulting in 21 studies that met the inclusion criteria (total 3929 patients). Five hundred and four patients presented with PIF, translating into an overall rate of 14% (95%CI: 10-18%, based on 21 studies). Among these cases with PIF, the proportion of symptomatic patients was 61% (95%CI: 52-69%, based on 14 studies). The total number of PIF was provided by 11 studies, with a total of 610 PIF (mean 1.65/patient that develop PIF). The most common locations were: 39.7% sacro-iliac joint; 33.9% body of the sacrum; 13% pubis; 7% lumbar vertebra; 2.8% iliac bone; 2.1% acetabulum; and 1.5% femoral head/neck.

Conclusions:
The incidence of PIF after radiotherapy for gynecological cancer is high (14%) with the majority affecting the sacral bone/joint (73.6%). Post-treatment bone surveillance is recommended since almost forty percent of the patients were asymptomatic at the time of PIF diagnosis. Strategies to prevent the fracture in these patients are necessary.

Figure 1. Systematic Search

Figure 2. Meta-analysis of (A) the overall rate of PIF; and (B) the proportion of symptomatic cases.

Figure 3. Distribution of the fractures sites.