

"A BAD BREAK": A REVIEW OF IMAGING INJURIES AND LESIONS AROUND THE HIP AND PELVIS USING CLAY MODELS: A RESIDENT TEACHING TOOL

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Background

Models can be created by residents or student as a teaching tool to demonstrate common hip and pelvic pathologies. The 3D models is an active learning tool that can be used to help increase understanding and memory retention in residents, students, and patients.

Purpose

We discuss the use of clay and 3D printed models as a tool to teach residents, students and patients about the anatomy and pathology of the pelvis as seen on MRI.

We describe various hip and pelvic pathologies such as avascular necrosis, crush, axial loading, and typical osteoporotic injuries.

Methods

We created clay models of various hip and pelvic pathologies to provide a hands-on approach to learning.

This approach uses active learning to increase understanding and memory retention.

Axial Loading Injury

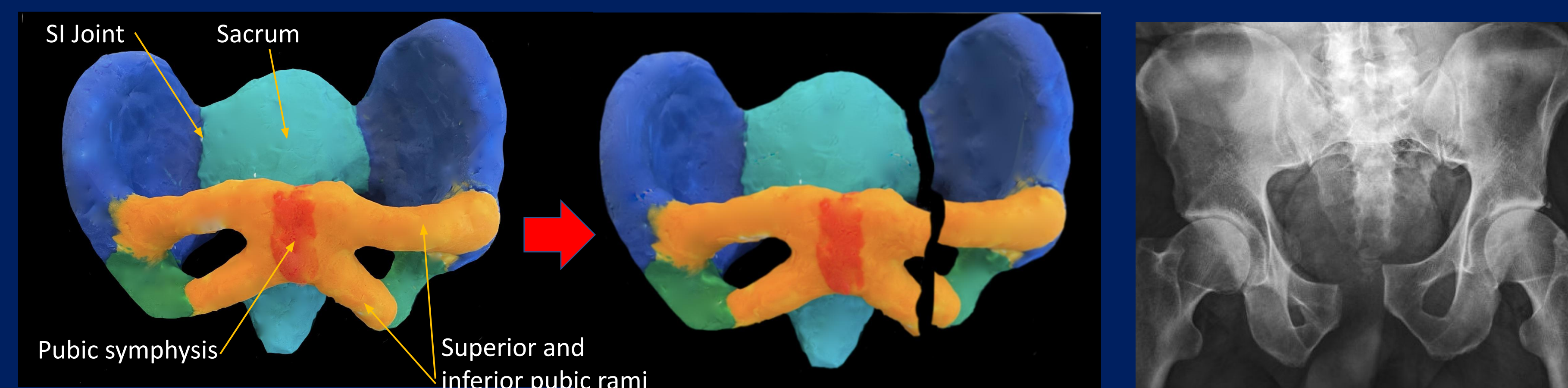


Figure 1: Clay model of a normal pelvis (left) and a model demonstrating a vertical shear injury (middle) with fracture through the left superior and inferior pubic rami (in orange) and SI joint injury. Pelvic AP radiograph (right) demonstrates vertical shear injury with pubic symphysis diastasis and left SI joint injury.

Axial loading force on the pelvis can result in a vertical shear injury. The sacrum is displaced inferior to the iliac wing. Most commonly the posterior pelvic injury is to the sacroiliac joint. Anterior pelvic injury is usually unilateral/bilateral rami fractures or widening of pubic symphysis.

Osteoporotic Fractures

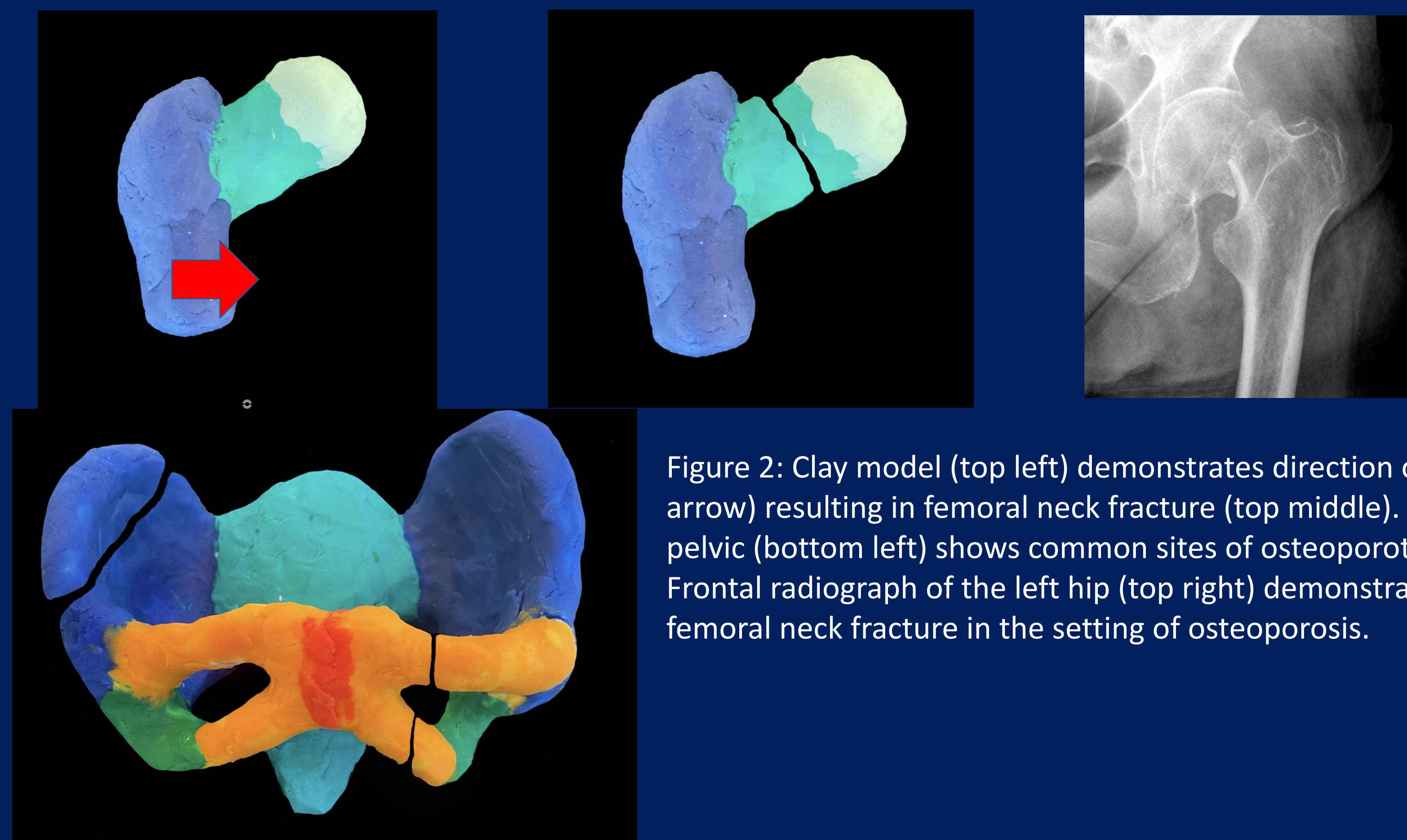


Figure 2: Clay model (top left) demonstrates direction of force (red arrow) resulting in femoral neck fracture (top middle). Clay model of the pelvic (bottom left) shows common sites of osteoporotic pelvic fractures. Frontal radiograph of the left hip (top right) demonstrates displaced femoral neck fracture in the setting of osteoporosis.

Osteoporotic fractures tend to occur with low-energy trauma such as a fall from the standing position. Fractures that are seen more frequently in patients with osteoporosis include femoral neck fractures and stable pelvic fractures. Stable pelvic fractures tend to be isolated fractures of the iliac spine, iliac wing, ischial tuberosity, or a pelvic ring fracture with minimal displacement

Avascular Necrosis

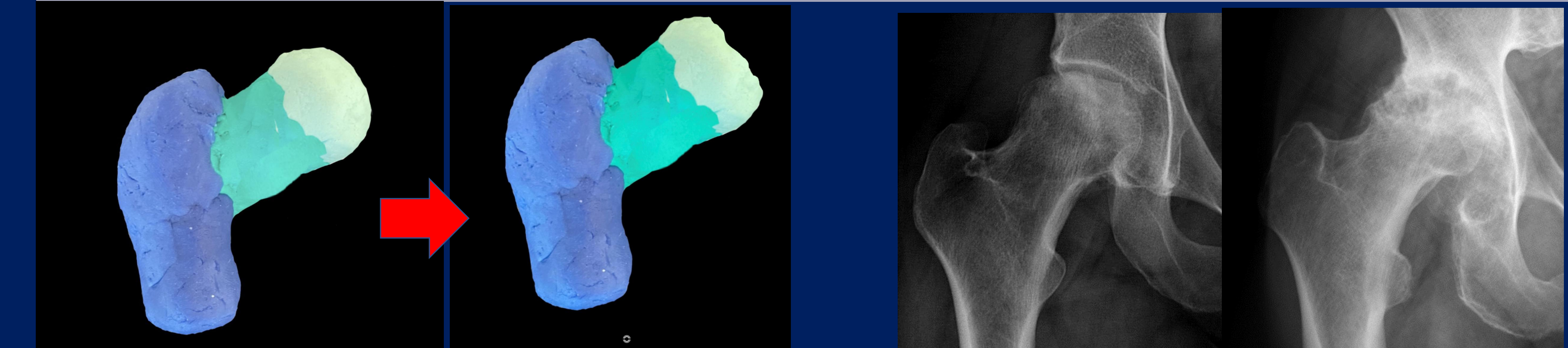


Figure 3: Clay model of the normal hip (left) and femoral head avascular necrosis (AVN) deformity (middle left). Two frontal radiographs of the right hip in different patients (middle right and right) demonstrating deformity of the femoral heads with sclerosis, lucencies, and significant joint space loss (right) consistent with AVN (red circles).

Crush Injury

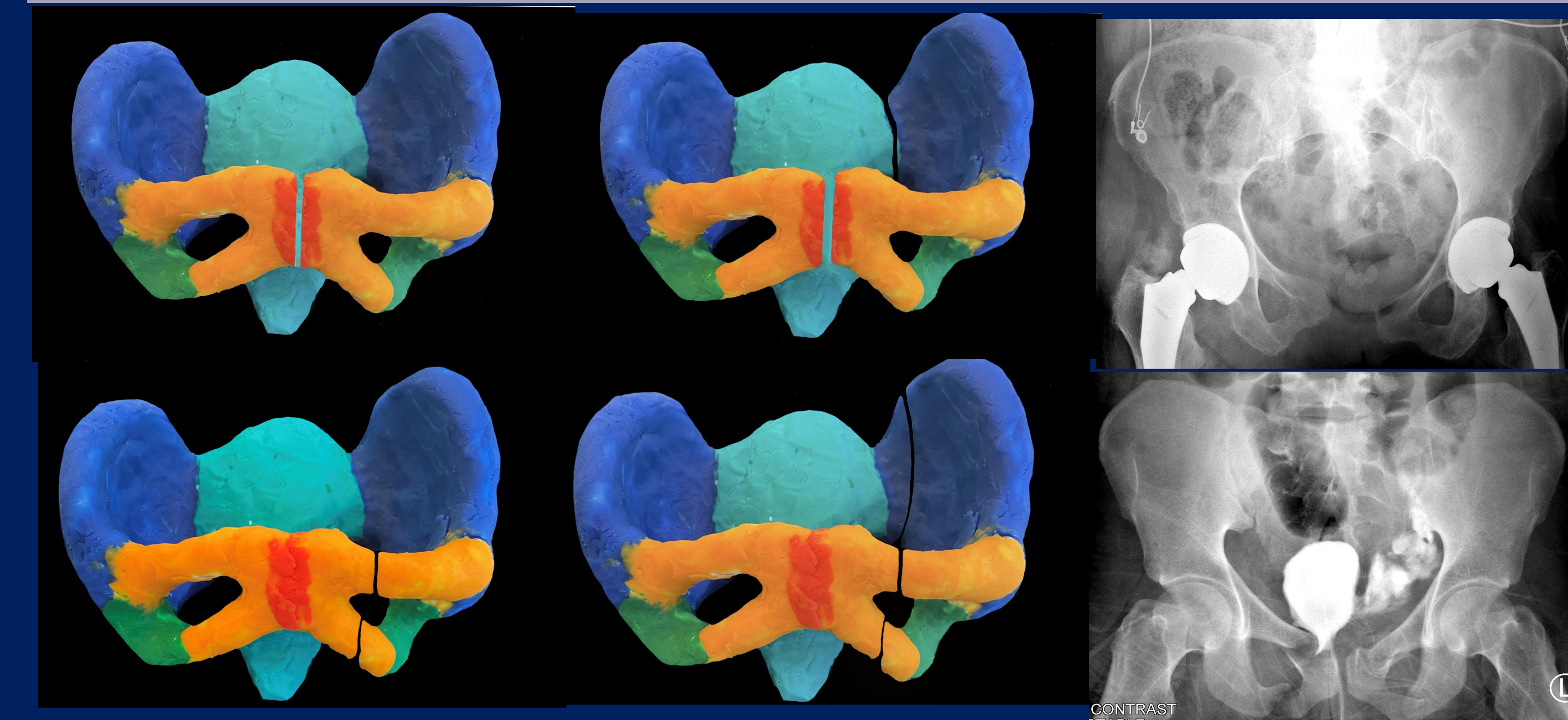


Figure 4: Clay models of the pelvis demonstrating anterior posterior compression injuries (top row) and lateral compression injuries (bottom row). Two frontal radiographs of the pelvis demonstrating AP compression injury (top right) and lateral compression injury (bottom right).

Anterior posterior compression injuries (top row) involves widening of the pubic symphysis and/or disruption of the sacroiliac joint. Lateral compression (bottom row) injuries result in ramus, iliac, and/or sacral fractures.

Conclusion

This project uses three-dimensional clay and 3D printed models as an active learning tool to help students, residents and patients to better understand the anatomy of the hip and pelvis, which will strengthen their ability to apply this knowledge to radiologic imaging and interpretation.

References

1. Alton TB, Gee AO. Classifications in brief: young and burgess classification of pelvic ring injuries. *Clin Orthop Relat Res.* 2014;472(8):2338-2342. doi:10.1007/s11999-014-3693-8
2. Khurana B, Sheehan SE, Sodickson AD, Weaver MJ. Pelvic ring fractures: what the orthopedic surgeon wants to know. *Radiographics.* 2014;34(5):1317-1333. doi:10.1148/rg.345135113
3. All images were obtained from the Westchester Medical Center PACS.