Dual-energy x-ray absorptiometry: incidental findings

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Purpose

Nowadays a lot of emphasis is given to findings incidentally discovered during imaging or other diagnostic examinations. An "incidental finding" is defined as an observation noted in the dictated radiology report that is not directly related to the aims of the respective research study as listed in the protocol title [1-2]. The detection of an incidental finding may or may not influence clinical history and management of patients. However, any finding has always an impact on health economy, increasing time spent to analyze imaging exams or needing further examinations to reach a final diagnosis.

The frequency of incidental findings depends on imaging modalities, body regions and age of patients under investigation [1]. The majority of studies in literature evaluated incidental findings focusing on CT and MR imaging [3-7]. To our knowledge, no one considered to investigate dual-energy x-ray absorptiometry (DXA) with this purpose so far. DXA is sometimes forgotten to belong to the same family of imaging techniques, based on a conventional x-ray source of energy, with similar physical and technological principles. New DXA technologies provide improved spatial resolution and high image quality.

Our aim was to review DXA examinations to detect collateral findings that might be reported or not by radiologists and to highlight the potential impact of these results on patient healthcare. Moreover an analysis of incurred pitfalls was performed.
Methods and Materials

We retrospectively and randomly reviewed 680 DXA exams (177/680-26.0% whole-body, 81/680-11.9% vertebral fracture assessment, 212/680-31.2% lumbar spine, 210/680-30.9% femur) that were performed in our institution with a new DXA equipment (Lunar iDXA, GE Healthcare, Madison, WI, USA) to find out incidental findings in bone or soft tissues that may have or not any importance on patient clinical history. We examined all the images and interpreted all incidental findings to make or to suppose a diagnosis. Whenever an incidental finding was discovered the physician’s report was read to investigate whether this finding was considered in the report, apart from the proper aim of the densitometric exam. Afterwards, a deep search for other imaging methods in patient’s clinical history was performed to check the presence and nature of such finding. Besides, the whole data-package of our Hospital was investigated including all imaging techniques (i.e. magnetic resonance imaging, computed tomography, conventional radiography, ultrasonography, nuclear medicine) and available case history, to understand whether that finding was already known. Additionally, scoliosis and arthrosis were detected and graded and other pitfalls were collected.
Results

The population included 187 males and 493 females (58±14 year-old). Incidental findings were discovered in 105/680 patients with an overall incidence of 15.4% (18/105-17.1% whole-body, 33/105-31.5% vertebral fracture assessment, 31/105-29.5% lumbar, 23/105-21.9% femur) (Fig. 1 on page 5, Fig. 2 on page 5). Biliary and urinary stones (7/105-6.7%; Fig. 3 on page 6; Fig. 4 on page 7), vascular calcifications (25/105-23.8% - aortic, iliac and femoral; Fig. 5 on page 8), other soft tissue calcifications (33/105-31.4% - e.g. tendons, lymphnodes, portal cavernoma, uterin fibroma, suprarenal adenoma, sarcoidosis, tuberculosis, intraparenchymatous calcifications; Fig. 6 on page 9, Fig. 7 on page 10, Fig. 8 on page 11), vertebral abnormalities or variants (25/105-23.8% - fractures, listhesis, vertebral cleft, additional vertebrae; Fig. 9 on page 12), other bone fractures or abnormalities (7/105-6.7%), and cardiomegaly (8/105-7.6%) were all met in DXA images. Among all these findings 46/105 (43.8%) could be verified by other imaging modalities. In 44/46 (95.6%) incidental findings were identified as "true" findings and DXA was able to orient the diagnosis (exact diagnosis in 31/46-67.4%); however, none of them was mentioned on available DXA reports. Due to the lack of other imaging investigations in 59/105 DXA exams (56.2%) we were not able to check the real presence and nature of incidental findings; on the other hand, in some cases the finding was considered sufficiently specific or typical, and any further examinations would not be required (29/59-49.2%) (Fig. 10 on page 13). Foreign bodies and pitfalls (such as surgical clips, rings, metallic underwears, breast prostheses, gastrointestinal or urinary contrast media) were found in 60 (8.8%) of all DXA exams (Fig. 11 on page 14, Fig. 12 on page 15). Finally, moderate-severe arthrosis was found in 15.4% of all patients, and 9.9% presented with scoliosis.
Fig. 1: Distribution of incidental findings in DXA examinations

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Fig. 2

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Fig. 3: Lumbar spine DXA and abdominal CT: urinary stones in the right kidney

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Fig. 4: Lumbar spine DXA shows a right paravertebral calcification (circle area). The abdominal CT scan confirmed calculosis of the transplanted kidney (broken arrow)

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**Fig. 5:** Vascular calcifications. Aortic calcifications as detected by vertebral fracture assessment DXA scan, by spine radiograph and by sagittal and coronal CT reconstructions (arrowheads) (A); Femoral arterial calcifications showed by DXA (arrows), and CT scan at iliac level of the same patient (broken arrows) (B)

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**Fig. 6:** Calcified lymphnodes in tuberculosis disease: vertebral fracture assessment DXA scan (arrowheads), lateral chest radiograph (arrows) and sagittal CT reconstruction (broken arrow)

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Fig. 7: Calcified uterine fibroma: whole-body DXA (pelvis enhanced in the box, arrow) and pelvic radiograph (broken arrow)

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**Fig. 8:** Sarcoidosis: lumbar spine DXA and CT appearance (calcified nodes in the boxes)

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**Fig. 9:** Metastatic bone involvement in breast cancer after chemotherapy. LVA and sagittal thick CT reconstruction (white arrows: focal density change of L3)

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**Fig. 10:** Rectangular area circumscribed a vertebral cleft of L5 in a lumbar spine DXA. Circle area addresses to left paravertebral calcifications, with no previous imaging techniques available to confirm the finding (renal calculosis?)

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Fig. 11: Bra clips (A) and surgical clips (B) in lumbar spine DXA

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Fig. 12: Contrast medium (A) and breast prostheses (B) in whole-body DXA

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Conclusion

An interpreting physician should treat the DXA image with the same attention given to any other x-ray image, in reference to both incidental findings and pitfalls. Sometimes DXA may allow a "qualitative" diagnosis of collateral findings. Nevertheless some insignificant or "false" findings may affect specificity and generate further unnecessary diagnostic examinations, with potential negative effects on patient care and economy.
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