(27) 骨質疏鬆症的臨床新進展

Clinical Update on Osteoporosis

間:114年6月29日(星期日)08:30~12:00 點:臺北榮民總醫院 致德樓第四會議室 時

地

08:20-08:30	Opening Remarks	曾令民副院長 Ling-Ming Tseng
	座長:胡啟民 教授 (Chii-Min Hwu)	
08:30-09:10	【智骨篩】-人工智慧於骨鬆篩檢之應用 VeriOsteo - Application of Artificial Intelligence in Osteoporosis Screening	陳昆輝部長 Kun-Hui Chen
09:10-09:50	台灣骨質疏鬆症醫療處置未被滿足之需求 Unmet need in Osteoporosis Management in Taiwan	吳至行教授 Chin-Hsing Wu
09:50-10:10	Coffee Break	
	座長:胡啟民 教授 (Chii-Min Hwu)	
10:10-10:50	脊椎手術骨質疏鬆症的評估與處理 Osteoporosis Evaluation and Management in Spine Surgery	周伯鑫主任 Po-Hsin Chou
10:50-11:30	乳癌病患之骨骼健康議題 Approach to Bone Health in the Patients with Breast Cancer	黃其晟主任 Chi-Cheng Huang
11:30-12:10	骨鬆接續治療與併發症處置 Osteoporosis Treatment in Steps and Complication Management	黃駿豐主任 Chung-Feng Huang
12:10-12:20	Closing Remarks	胡啟民教授 Chii-Min Hwu

VeriOsteo : Application of artificial intelligence in osteoporosis screening

【智骨篩】:人工智慧於骨鬆篩檢之應用

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Introduction: Osteoporosis screening is crucial for identifying individuals at risk of fractures. Dualenergy X-ray absorptiometry is the current gold standard for osteoporosis diagnosis. However, a significant portion of the population remains undiagnosed, highlighting the need for improved screening strategies.

Meterials and Methods: We utilize deep learning techniques to develop a model that analyzes chest X-ray (CXR) images for osteoporosis screening. Total 5122 paired CXR images and DXA reports was collected, enhanced and filtered in target level of T12 and L1. The dataset was separated into training, validating, and testing datasets. The first AI model assess the BMD from T12/L1 was developed. The second chozen DenseNet-121 model processes ROI image to estimate the final predicted BMD.

Results: In the clinical validation stage, we collected 440 paired CXR images and DXA reports from two different institutes. The validation showed an AUC of 0.946. Pearson's correlation coefficient was 0.88. The model demonstrated an overall accuracy/sensitivity/specificity of 89.0%/88.7%/89.4% respectively.

Discussion: Study on vertebral body fractures analysis X-ray images from these regions are not widely available. In comparison, our AI model correlated well with the gold standard DXA-BMD with good performance to screen for saBMD. Furthermore, in our clinical validation, when compared with similar AI models that analyze CXRs to predict lumbar BMD for the screening of osteoporosis, with high correlation.

Conclusion: Study on vertebral fractures analysis CXR are not widely available. Our AI model correlated well with gold standard DXA-BMD with good performance to screening osteoporosis. In the post-hoc study, this model still showed good usability clinically.

Unmet need in osteoporosis management in Taiwan

台灣骨質疏鬆症醫療處置未被滿足之需求

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The prevalence of osteoporosis (with or without fracture) is undoubtedly increasing with increasing age in Taiwan and worldwide. In 2050, the incidence of hip fracture will double in the so-called era of osteoporosis tsunami in the Asia–Pacific region. According to the HPA census of the elderly population in 1999, osteoporosis is one of the top 5 diseases among elderly people, especially women. However, the real-world diagnostic records and medication usage in the NHIRD are always far from the actual epidemiological reports. What are the reasons for these GAPs, and what is the unmet need for the prevention and management of osteoporosis in Taiwan? What is the useful strategy or most urgent step from patients, health professionals and health policy perspectives? What is the practical program for osteoporosis care in Taiwan? Given the inevitable status of the aged society in Taiwan, several issues with corresponding recommendations for osteoporosis are discussed.

- 1. The real-world prevalence of osteoporosis is still underestimated. A nationwide screening for osteoporosis in high-risk groups or elderly people is needed. The use of OSTAi and MOSTAi as the preliminary screening strategy, followed by DXA with FRAX calculation, is recommended.
- 2. The evaluation of fall risk and the emerging issue of sarcopenia are both important in fracture prevention. The routine screening of frailty and awareness of sarcopenia are recommended during both fracture admission and community screening.
- 3. The reimbursement of osteoporosis and fracture medication is still not satisfactory and is far from the international standard. MegaData analysis, cost-benefit studies and life-quality research are encouraged for elucidating the high CP value in the treatment of osteoporosis.
- 4. Male osteoporosis is also an important topic for further study. The AP consensus presents the acronym "STOP FRACTURE" to outline key topics, ranging from prevention and diagnosis to treatment, and long-term follow-up was proposed in 2024.
- 5. Prevention is better than a cure. In addition to secondary prevention, primary prevention is a top priority in the long-term management of osteoporosis. Fracture liaison service (FLS) has been well established in many hospitals and even clinics in Taiwan. How to upgrade and maintain the program of the FLS smoothly is a challenge. A reasonable reimbursement from the NHI is recommended but is an endless story in the near future.
- 6. Osteoporosis is a life-long chronic disease. Pharmacological management with sequential and longterm strategies is recommended. The rarely rare adverse events (ONJ, AFF) should be watched but not be overconcerned. More local studies and expert consensuses are needed to provide practical decisions in the clinical pathway.

Osteoporosis evaluation and management in the spine surgery

脊椎手術骨質疏鬆症的評估與處理

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Optimization of co-morbid conditions is commonly performed preoperatively to reduce adverse events and improve surgical outcomes. Osteoporosis is common and under-recognized among spine surgery patients. Poor bone health has been linked to worse outcomes and complications with pedicle screws loosening (PSL) or cage subsidence (CS) after spine surgery. Dual energy x-ray absorptiometry (DXA) examination is the gold standard diagnostic tool to evaluate the systemic bone quality. However, spur formation, degenerative scoliosis and instrumentation at lumbar spines may result in false negative in DXA examination. Moreover, 40% discordance between hip and spine DXA has been investigated.

In clinical practice, CT attenuation represents in Hounsfield Unit (HU) is a standardized format of the resultant image with the refences of Water at 0 HU Air at -1000 HU and Bone ranging from 100 to 1000 HU, respectively. Due to strong correlation between DXA-based T score and CT-based HU value, the CT-based HU value may be a more reliable parameter to represent local bone quality for spine instrumentation index levels. Our study group published several parameters such as smoking, overweight (BMI \geq 25), L1 HU <117, index pedicle tract HU < 120, and psoas-lumbar vertebral index (PLVI) < 0.85 were strongly associated with PSL or CS in lumbar instrumented fusion surgery. Regarding fixation in the osteoporotic spine (DXA T score less than -2.5), two common methods were clinically used such as polymethylmethacrylate (PMMA)-augmented fixation and hybrid fixation with screws and hook systems, which may provide stronger pullout strength to enhance pedicle screws fixation biomechanically.

In addition to enhance pullout strength, preoperative and postoperative bone health optimization with osteoporosis drugs is warranted to enhance patients' reported outcomes postoperatively. Bone health assessment and optimization are important for decreasing surgical risks and improving outcomes in spine surgery patients.

Approaches to bone health in the patient with breast cancer

乳癌病患之骨骼健康議題

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Breast cancer and its treatments can significantly impact bone health, leading to increased fracture risk and diminished quality of life. This abstract reviews current approaches to maintaining and improving bone health in patients with breast cancer. These approaches encompass risk assessment, lifestyle modifications, pharmacological interventions, and monitoring strategies. Risk assessment involves identifying patients at high risk of bone loss through clinical evaluation and bone mineral density (BMD) measurements. Lifestyle modifications, including adequate calcium and vitamin D intake, regular weight-bearing exercise, and avoidance of smoking and excessive alcohol consumption, are essential components of bone health management. Pharmacological interventions, such as bisphosphonates, denosumab, and selective estrogen receptor modulators (SERMs), play a crucial role in preventing and treating bone loss. The selection of appropriate therapy is guided by individual patient risk factors, treatment history, and potential side effects. Regular monitoring of BMD and bone turnover markers is recommended to assess treatment efficacy and detect early signs of bone loss. A multidisciplinary approach, involving oncologists, endocrinologists, and other healthcare professionals, is crucial for optimizing bone health outcomes in patients with breast cancer.

Osteoporosis treatment in steps and complication management

骨鬆接續治療與併發症處置

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Osteoporosis is a chronic, progressive disease characterized by decreased bone mineral density and structural deterioration, leading to an increased risk of fractures. Recent advancements in osteoporosis management highlight the importance of sequential treatment strategies to optimize bone health and minimize complications. Transitioning between therapeutic agents, particularly from anabolic to antiresorptive therapies, plays a critical role in maintaining long-term bone strength. Studies indicate that sequential therapy—such as initiating treatment with anabolic agents like teriparatide or romosozumab, followed by bisphosphonates or denosumab—more effectively preserves bone density and reduces fracture risk compared to monotherapy or treatment interruption.

One of the major challenges in osteoporosis management is addressing complications associated with long-term medication use. Discontinuing denosumab without subsequent antiresorptive therapy significantly increases vertebral fracture risk, underscoring the need for a well-structured treatment plan. Additionally, concerns about medication-related complications, particularly osteonecrosis of the jaw (ONJ), have led to ongoing discussions regarding the optimal duration of bisphosphonate therapy and drug holidays. Recent studies suggest that treatment decisions should be guided by patient-specific factors such as age, fracture history, and comorbidities to minimize risks while ensuring continued fracture prevention.

As treatment strategies evolve, personalized approaches incorporating sequential therapy and risk-based complication management are gaining traction. Emerging therapies, including novel bone-forming agents and combination treatments, present new opportunities for improving long-term outcomes. Future research should focus on optimizing treatment sequencing, refining transition strategies, and identifying biomarkers that predict individual treatment responses to further enhance osteoporosis management and patient care.