J. Miner. Stoffwechs. Muskuloskelet. Erkrank.

https://doi.org/10.1007/s41970-021-00174-6

29. Osteoporose Forum – Young Investigators

14.–16. Oktober 2021, St. Wolfgang

öegkm
Österreichische Gesellschaft für Knochen und Mineralstoffwechsel
Austrian Society for Bone and Mineral Research

1
Nutritional habits of patients with rare bone diseases & osteoporosis

Amadea Medibach[1,2,3], Judith Haschka[1,2], Martina Behanova[1], Julia Feurstein[1,2], Annemarie Kocijan[4], Heinrich Resch[3,5], Daniela Kritsch[1], Angela Distel[1], Jochen Zwerina[1,2], Roland Kocijan[1,2,3]*

[1] Ludwig Boltzmann Institute of Osteology at Hanusch Hospital of OEGK and AUVA, Trauma Center Meidling, 1st Med. Dept. Hanusch Hospital, Vienna, Austria; [2]Hanusch Hospital Vienna, 1st Medical Department, Vienna, Austria; [3]Sigmund Freud University Vienna, School of medicine, Medical Faculty of Bone Diseases, Vienna, Austria; [4]Optimal Essen e. U., Vienna, Austria; [5]St. Vincent Hospital Vienna, 2nd Department of Internal Medicine, Vienna, Austria

Background: Osteogenesis imperfecta, Hypophosphatasia, X-linked Hypophosphatemia and Ehlers Danlos syndrome are rare genetic bone diseases. As there is currently no cure, patients are advised to have a health-conscious lifestyle.
Patients/Methods: This project aims to collect data on complementary and alternative medicine, nutritional habits and quality of life in rare bone disease patients (RARE), comparing them to an osteoporosis group (OPO) and healthy controls (CTRL). In our first analysis we used a standardized nutritional questionnaire, targeting bone influencing foods and nutrients.
Results: A total of 114 people were included in the study (RARE $n=40$, 49.3 years; OPO $n=46$, 66.9 years; CTRL $n=28$, 48.6 years). The body mass index (BMI) averages at 25.1 in RARE, 24.4 in OPO and 27.1 in CTRL. In the RARE group 23.7 % stated, that they completely refrain from dairy products, compared to 8.7 % OPO and 10.7 % CTRL. More than two daily portions of vegetables were stated only by 13.6 % of RARE, 15.6 % of OPO and 14.3 % of CTRL patients, but fruit consume once to twice per day by 59.5 %, 73.3 % and 71.4 %, respectively. Meat consume more than 3 portions per week was stated in 35.7 % of CTRLs versus only 13.1 % in RARE and 13.0 % in OPO. Recommended fish consumption was declared by more than 50 % of subjects. Light beverage consumption was generally low (5.3 %, 6.7 % and 3.6 %).
Conclusion: The current trend suggests, that most patients with rare bone diseases or osteoporosis have not implemented the recommended bone protective nutrition.
Keywords: rare bone diseases, osteoporosis, nutrition, osteogenesis imperfecta, x-linked hypophosphatemia

2
Analysis of bone architecture using fractal-based TX-Analyzer™ in adult patients with osteogenesis imperfecta

Daniel A. Kraus[1,2], Judith Haschka[1,2,3], Stephanie Huber[1], Jakob E. Schanda[4,5,6], Martina Behanova[1], Philip Meier[7], Arian Bahrami[8], Shahin Zandieh[8], Christian Muschitz[3], Heinrich Resch[3,9], Matthias Mähr[1], Katharina Rötzer[10,11], Göykan Uyanik[10,11], Jochen Zwerina[1,2], Roland Kocijan[1,2,9]*

[1] Ludwig Boltzmann Institute of Osteology at Hanusch Hospital of OEGK and AUVA Trauma, Center Vienna-Meidling, Vienna, Austria; [2]Hanusch Hospital Vienna, I Medical Department, Vienna, Austria; [3]St. Vincent Hospital Vienna, II Medical Department, Vienna, Austria; [4]AUVA Trauma Center Vienna-Meidling, Department for Trauma Surgery, Vienna, Austria; [5]Ludwig Boltzmann Institute for Experimental and Clinical Traumatology, Vienna, Austria; [6]Austrian Cluster for Tissue Regeneration, Vienna, Austria; [7]Image Biopsy Lab, Vienna, Austria; [8]Hanusch Hospital Vienna, Department of Radiology and Nuclear Medicine, Vienna, Austria; [9]Sigmund Freud University Vienna, Medical Faculty of Bone Diseases, Vienna, Austria; [10] Hanusch Hospital Vienna, Department of Medical Genetics, Vienna, Austria; [11] Sigmund Freud University, Medical Faculty of Genetics, Vienna, Austria

Background: Osteogenesis imperfecta is a rare genetic disorder characterized by impaired bone quality and quantity. TX-Analyzer™ is a new fractal-based technique assessing bone microstructure based on conventional radiographs. We explored whether TX-Analyzer™ can discriminate osteogenesis imperfecta patients from controls and investigated the correlation between TX-Analyzer™ and crucial imaging techniques.
Patients/Methods: 29 osteogenesis imperfecta patients and 58 age- and gender-matched controls were analyzed. The parameters bone structure value, bone variance value and bone entropy value were measured at the vertebral bodies of T7 to L4. Furthermore, bone mineral density by dual energy x-ray absorptiometry, trabecular bone score and trabecular bone microstructure by high-resolution peripheral quantitative computed tomography were correlated to them. The accuracy of TX-Analyzer™ in detecting osteogenesis imperfecta was assessed with area under curve analysis of receiver operating characteristic.
Results: Bone entropy value of thoracic and lumbar spine were significantly lower in osteogenesis imperfecta patients compared to controls (both $p<0.001$). Bone entropy value of the thoracic spine correlated significantly to trabecular bone score ($\rho=0.427$, $p=0.042$) as well as trabecular number ($\rho=0.603$, $p=0.029$) and inhomogeneity of the trabecular network ($\rho=-0.610$, $p=0.027$) at the radius. No correlations were found between bone entropy value and bone mineral density. Bone entropy value of thoracic and lumbar spine had an area under the curve of 0.81 ($p<0.001$) and 0.73 ($p=0.008$), respectively.
Conclusion: The TX-Analyzer™ can discriminate patients with osteogenesis imperfecta from controls. Low to no correlations with conventional meth-

Bei den mit * gekennzeichneten Autoren handelt es sich um die präsentierenden Autoren.

Published online: 28 October 2021

ods suggest, that the TX-Analyzer™ may indicate a new and independent examination tool in osteogenesis imperfecta.
Keywords: Osteogenesis imperfecta, TX-Analyzer™, Fractal-based analysis Bone microstructure, Conventional radiography

3
High risk for skeletal related events in osteolytic bone metastasis treated with denosumab

Veronica Falcone[1], Elisabeth Reiser[2], Giulia Vatteroni[3], Florian Heinzl[1], Lenka Grula[1], Georg Pfeiler[1]*

[1] Department of Gynecology and Obstetrics, Division of Gynecology and Oncology, Medical University of Vienna, Vienna, Austria; [2]Department of Gynecology and Obstetrics, Division of Endocrinology and reproductive medicine, Medical University of Innsbruck, Innsbruck, Austria; [3]Department of Biomedical imaging and Image-guided therapy, Medical University of Vienna, Vienna, Austria

Background: Clinical consequences of bone metastatic breast cancer are associated with skeletal related events like instability, pathologic fractures, chronic pain and decreased rates of survival. With the advent of the human monoclonal antibody denosumab, a significant decrease in skeletal related events has been registered. However, whether this result can be reached in all types of bone metastasis, is still under debate. The primary goal of our study was the evaluation of bone metastasis response to denosumab according to lesion type (osteoblastic, osteolytic, mixed).
Patients/Methods: This retrospective study was based on data retrieved from all patients suffering from breast cancer who attended the Department of gynecology and oncology, Medical University of Vienna, between 1994 and 2018. A total of 60 patients with advanced breast cancer, bone metastasis and current denosumab therapy, was included. CT diagnosed bone metastasis were classified as osteolytic, osteoblastic or mixed. Metastases response to denosumab, as well as bone instability and pathologic fractures were evaluated. A p value ≤ 0,05 was classified as statistically significant.
Results: Out of the 60-bone metastasis, 20 (33.3 %) were classified as osteoblastic, 25 (41.6 %) as osteolytic and 15 (25 %) as mixed. Participants showed similar age at cancer first diagnosis (46.42 vs 59.41 vs 56.5 $p = 0.55$), BMI (25.45 vs 27.56 vs 23.43 $p = 0.13$), menopausal status ($p = 0{,}68$) and median overall survival after bone diagnosis (31 vs 60 vs 112 $p = 0.29$).
However, in patients with osteolytic metastasis, significant higher skeletal related events like bone instability ($p = 0.01$) and bone pathologic fractures ($p = 0.03$) were reported.
Interestingly, the extension of bone disease at first exam did not correlate with median overall survival ($p = 0.48$). A strong negative correlation between breast tumor MIB-1 proliferative activity and overall survival.
Conclusions: Patients affected by osteolytic metastasis treated with denosumab developed more skeletal related events as compared to osteoblastic and mixed metastasis, thus, with no significative impact on overall survival. Hence, further research in order to develop targeted therapies for osteolytic metastasis is needed.
Keywords: Advanced breast cancer, Bone metastasis, Denosumab, Skeletal related events, Pathological fractures

4
Retrospective observational study: anemia in hypoparathyroidism–a common companion

S. Geiger[1], C. Starchl[1], G. Wünsch[2], A. Tmava[3], K. Amrein[1]

[1] Division of Endocrinology and Diabetes, Department of Internal Medicine, Medical University of Graz, Austria; [2]Institute of Medical Informatics, Statistics and Documentation, Medical University of Graz, Graz, Austria; [3]Department of Psychiatry and Psychotherapy, Medical University of Graz, Austria

Background: Hypoparathyroidism is a rare endocrine disorder characterized by hypocalcemia and inadequately low parathyroid hormone levels (PTH). Anemia is a common comorbidity in many chronic diseases. We investigated a possible link between hypoparathyroidism and anemia.
Methods: In a retrospective observational study, we identified 226 patients with hypoparathyroidism in 19 Styrian hospitals and analyzed their laboratory data from 2013 to 2021. We excluded 27 patients because of missing data. Anemia was defined as hemoglobin <12 mg/dl for women and <13 mg/dl for men.
Results: Overall, 56.3 % of all patients were anemic during the observed time period. The investigated cohort had a mean age of 62.419.5 years and consisted of 144 women (72.4 %) and 55 men (27.6 %). 51.4 % of all women and 69.1 % of all men presented with anemia since 2013. On average, 85 patients had their blood works done per year and we had access to 4 ± 2.5 years of laboratory data per patient. We identified 51 women <55 years ("premenopausal") of which 41.2 % had anemia. In anemic premenopausal women 29.3 % had a ferritin below 30 ng/ml and 44.8 % had a transferrin saturation below 20 %. The hemoglobin content of all anemic patients correlated significantly with the estimated glomerular filtration rate (eGFR) ($p < 0.001$). The mean eGFR of patients with and without anemia was 52.8 and 72.7 ml/min/1.7 m^2, respectively. The cause of anemia was not determinable in most patients because of missing data, but where available, iron deficiency and renal anemia appeared to be the most common cause.
Conclusion: In patients with hypoparathyroidism, anemia appears to be a very common comorbidity. This is a novel and highly relevant finding, as some complaints such as fatigue may be explained rather by anemia than by hypoparathyroidism and should prompt individual assessment and treatment. Further research is necessary to fully understand the underlying mechanisms.

5
Hypoparathyreoidismus und Fertilität, Schwangerschaft und Stillzeit

T. Lerchl[1], M. Wölfler[2], A. Fahrleitner-Pammer[1], K. Amrein[1]*

[1]Klinische Abteilung für Endokrinologie und Diabetologie, Medizinische Universität Graz, Graz, Österreich; [2]Klinische Abteilung für Geburtshilfe, Medizinische Universität Graz, Graz, Österreich

Fragestellung: Von der seltenen Erkrankung Hypoparathyreoidismus (HypoPT) sind Frauen überproportional häufig betroffen (70–80 %). Da bei prämenopausalen Patientinnen ein Kinderwunsch bestehen kann und Schwangerschaft und Stillzeit eine besondere Belastung für den Mineralhaushalt darstellen, ist der Einfluss eines *chronischen HypoPT* auf Schwangerschaft, Stillzeit und Fertilität höchst relevant.
Material und Methode: Aus der prospektiven „HypAus-Studie" wurden 23 Patientinnen identifiziert *(Einschlusskriterien: weiblich, Diagnose: chronischer HypoPT)*, wovon sich 21 bereit erklärten, an einer Befragung teilzunehmen. Mittels Fragebogen wurden Informationen zu Fertilität, Verlauf der Schwangerschaft/en und Geburt/en sowie dem Stillverhalten erhoben. Zusätzlich wurde im Rahmen einer Literaturrecherche die Thematik bearbeitet.
Ergebnisse: Elf Frauen waren kinderlos, neun bekamen ein oder mehrere Kinder *vor* Manifestation des HypoPT, es gab keine erfolgreichen spontanen Schwangerschaften. Eine einzige Frau hatte unter bestehendem HypoPT eine erfolgreiche Schwangerschaft durch in-vitro Fertilisation. 16 der 21 Frauen waren zum Diagnosezeitpunkt prämenopausal. Davon hatten neun keine Kinder, bei drei Frauen lag ein unerfüllter Kinderwunsch vor. Weiters äußerten einige prämenopausale Frauen aufgrund ihrer Vorerkrankung starke Bedenken bezüglich einer möglichen Schwangerschaft.
Eine starke Hypocalcämie der Mutter während der fetalen Skelettentwicklung kann die Nebenschilddrüsen stimulieren (reaktiver Hyperparathyreoidismus) und zu einem Phänotyp ähnlich einer schweren Rachitis mit Demineralisierung des fetalen Skeletts, Krümmung der Röhrenknochen, Osteitis fibrosa cysica, intrauterinen Frakturen, Abort und einem niedrigen Geburtsgewicht führen. Bei maternaler Hypercalcämie können die fetalen Nebenschilddrüsen unterdrückt werden (fetaler HypoPT) und dadurch Wachstumsstörungen, Tetanie und Abort oder schwere peripartale

Komplikationen auslösen. Bei der Mutter kann ein erhöhter Calciumspiegel Nierensteine, Pankreatitis und Präeklampsie begünstigen.
Schlussfolgerung: Die Stabilisierung des Ca^{2+}-Spiegels im unteren Normbereich während der Schwangerschaft kann sehr herausfordernd sein. Da der Substitutionsbedarf stark variieren kann, wird eine individuelle Dosisanpassung und Kontrolle in 2–3-wöchigen Abständen empfohlen. Neugeborene sollten auf Folgen einer Hyper- und Hypokalzämie untersucht werden. Bei gut eingestelltem HypoPT zeigen sich keine Auswirkungen auf den Schwangerschaftsverlauf und geringer Einfluss auf das Gesamtrisiko einer Schwangerschaft. Der Zusammenhang zwischen unerfülltem Kinderwunsch und Hypoparathyroidismus sollte weiter erforscht werden.

6
Identifying adult hypophosphatasia in the rheumatology unit

Julia Feurstein[1,2], Benjamin Hadzimuratovic[1,2], Martina Behanova[1], Judith Haschka[1,2], Katharina Roetzer[3,4], Gökhan Uyanik[3,4], Martina Witsch-Baumgartner[5], Georg Schett[6], Jochen Zwerina[1,2], Roland Kocijan[1,2,7]*

[1]Ludwig Boltzmann Institute of Osteology at Hanusch Hospital of OEGK and AUVA Trauma Center Meidling, 1st Medical Department, Hanusch Hospital, Vienna, Austria; [2]Hanusch Hospital Vienna, 1st Medical Department, Vienna, Austria; [3]Hanusch Hospital Vienna, Center for Medical Genetics, Vienna, Austria; [4]Sigmund Freud University, Medical Faculty of Genetics, Vienna, Austria; [5]Medical University Innsbruck, Department of Medical Genetics, Molecular and Clinical Pharmacology, Division Human Genetics, Innsbruck, Austria; [6]Department of Internal Medicine 3, Friedrich-Alexander-University Erlangen-Nuremberg and Universitätsklinikum Erlangen, Erlangen, Germany; [7]Sigmund Freud University, Medical Faculty of Bone Diseases, Vienna, Austria

Objectives: The most frequent manifestation in adult Hypophosphatasia is musculoskeletal pain. The unspecific nature of its clinical presentation may prevent correct diagnosis.
Methods: Over a period of 10 years 9522 patients were screened in a rheumatological outpatient unit. Serum alkaline phosphatase levels ≤40 U/l were found in 524 patients. After screening for secondary causes, 73 patients were invited for clinical evaluation. Genetic testing was performed in 23 patients with suspected hypophosphatasia. Logistic regression models were used to estimate the association of each clinical factor with hypophosphatasia.
Results: Mutations in the *ALPL* gene were observed in 57 % of genetically screened patients. Arthralgia, fractures and pain were the leading symptoms in hypophosphatasia patients. Chondrocalcinosis (OR 29.12; 95 % CI 02.02–1593.52) and dental disease (OR 8.33; 95 % CI 0.93–143.40) were associated with hypophosphatasia independent of body mass index. Onset of symptoms in hypophosphatasia was at 35.1 (14.3) years, with a mean duration from symptoms to diagnosis of 14.4 (8.1) years. Bone mineral density and trabecular bone score as well as bone turnover markers were not indicative for hypophosphatasia.
Conclusion: Hypophosphatasia can mimic joint diseases. Thus, in patients with uncertain rheumatologic complaints and low alkaline phosphatase, hypophosphatasia should be considered as potential diagnosis.
Key words: hypophosphatasia, HPP, arthralgia, alkaline phosphatase, chondrocalcinosis

7
Thirty years of hip fracture incidence in Austria; is the worst over?

Hans Peter Dimai[1], Berthold Reichardt[2], Emanuel Zitt[3,4,5], Hans Concin[3], Oliver Malle[1], Astrid Fahrleitner-Pammer[1], Axel Svedbom[6], Wolfgang Brozek[3]*

[1] Divison of Endocrinology & Diabetology, Department of Internal Medicine, Medical University of Graz, Graz, Austria; [2]Austrian Health Insurance Fund, Eisenstadt, Austria; [3]Agency for Preventive and Social Medicine, Bregenz, Austria; [4]Vorarlberg Institute for Vascular Investigation and Treatment (VIVIT), Feldkirch, Austria; [5]Department of Internal Medicine 3 (Nephrology and Dialysis), Feldkirch Academic Teaching Hospital, Feldkirch, Austria; [6]ICON Plc, Stockholm, Sweden

Purpose: In the Austrian population ≥50 years, nationwide hip fracture incidences over a period of 20 years (1989–2008) have shown an initial steep increase, followed by a levelling-off during the last few years of observation. The purpose of the present study was to follow up on hip fracture incidences for another 10 years (2009–2018), and to analyze trends over the entire period of 30 years.
Methods: ICD-10 code classes S72.0, S72.1, and S72.2 were applied. All data were retrieved from the Statistics Austria database and its hospital discharge register. Annual absolute numbers, crude and age-standardized incidences as well as incidence rate ratios (IRR) were stratified by sex and 5-year age intervals, and calculated by using a correction factor for multiple registrations.
Results: Total number of hip fracture cases increased from 13,984 (2009) to 14,640 (2015), and decreased thereafter to 14,457 (2018), despite a persistent increase in men. Age-standardized incidences peaked at 476/100,000 (2010), followed by a decrease to 408/100,000 (2018). The observed overall decrease was mainly driven by the female population. Incidence rate ratios (IRRs) yielded a statistically significant average annual decrease of age-standardized incidences in both women and men (ΔIRR 0.984; 0.981–0.987).
Conclusion: While absolute numbers of hip fracture in women showed a slight decrease during the last 10 years of observation, numbers in men continued to increase. Age-standardized incidences nevertheless decreased in both men and women, which may be interpreted as a trend in the right direction. However, due to the rapid ageing of the population it cannot be precluded that this trend will be compromised during the next few decades.
Keywords: Epidemiology, hip fracture, Austria, incidence trend

8
Impact on quality of life by osteoporosis treatment after fragility fracture

O. Malle[1], F. Borgstroem[2], A. Svedbom[3], A. Fahrleitner-Pammer[1], S. V. Dimai[4], H. P. Dimai[1]*

[1] Medical University of Graz, Division of Internal Medicine, Department of Endocrinology and Diabetology, Graz, Austria; [2]Karolinska Institutet, Dept. of Learning, Informatics, Management and Ethics, Stockholm, Sweden; [3]MAPI Group, Real World Strategy and Analytics, Stockholm, Sweden; [4]Medical Faculty, Heinrich Heine University, Duesseldorf, Germany

Introduction: Osteoporotic fractures cause complex disability, morbidity, functional limitations and higher risk for re-fractures. Beside secondary prevention of fractures, osteoporosis treatment also has been proposed to be effective in improving health-related quality of life. This paper aims to assess the impact of osteoporosis treatment on quality of life (QoL) after a fragility fracture.
Methods: Based on data of the International Costs and Utilities Related to Osteoporotic fractures Study (ICUROS), a multinational study assessing the consequences after fragility fractures. Recruitment was performed in 8 different trauma centers throughout Austria. Osteoporosis treatment and QoL using the European Quality of Life-5 Dimensions-3 Levels (EQ5D) were assessed in individuals having sustained a fragility fracture and 4, 12 and 18 months thereafter. For analysis, patients were divided into two groups whether osteoporosis treatment was initiated or not, and differences in QoL was assessed with the chi-squared test using the statistical software package IBM® SPSS® Statistics Version 23.
Results: A total of 922 patients were eligible for analysis. However, at the end of study, there was a loss of follow-up in 396 patients (43.0 %). At baseline (time of fracture), the two subgroups were comparable except of differences regarding usual activities. At all follow-up analyses, osteoporosis treatment did not result in a significant difference in all assessed dimensions of QoL.
Conclusions: Despite multiple studies demonstrating osteoporosis treatment to be effective in improving QoL, the Austrian data of ICUROS does not support a significant difference in QoL after a fragility fracture whether receiving osteoporosis treatment or not.

Keywords: Quality of life, osteoporosis, fracture, treatment

9

The impact of lockdown during COVID-19 pandemic on hip fracture cases in Austria

Olliver Malle[1], Wolfgang Brozek[2], Michael Szivak[3], Hans Peter Dimai[1]*

[1] Medical University of Graz, Department of Internal Medicine, Division of Endocrinology and Diabetology, Graz, Austria; [2]Agency for Preventive and Social Medicine, Bregenz, Austria; [3]Department of Medical Documentation and Statistics, Austrian Trauma Insurance Agency (AUVA), Vienna, Austria

Introduction: Social lockdown has been repeatedly imposed worldwide due to the coronavirus disease 2019 (COVID-19). Resultant isolation with less physical activity and restricted health care access may have an impact on fracture incidences. The aim of this analysis was to assess the effect of a social lockdown on hip fracture cases in Austria.
Methods: Based on the data of the Austrian Workers' Compensation Board (AUVA), which is the social insurance for the majority in Austria, hip fracture cases in the time period March 16th to May 31st, 2020 (first lockdown period in Austria) were compared with those in the same period of previous years (2016–2019). Further analysis included stratification by gender, age and weekly intervals using repeated measures analysis of variance (ANOVA), while a p-value of less than 0.05 was considered statistically significant.
Results: In the time period March 16th to May 31st 2020 the fracture cases of 445 lied within the standard deviation (SD) of years before (438 ± 20.1). The mean cases of weekly separated intervals in 2016–2019 did not differ significantly from those in 2020. In patients aged 50 to 69 years, the fracture cases in 2020 was below the SD of those in years before (64 vs. 77 ± 10). Stratified by weekly intervals and age group, mean fracture cases of years before were comparable with those of 2020, except 2018, which had significant lower rates in patients aged 50–69 years ($p < 0.05$). Separated by gender, this difference was only seen in women.
Conclusion: Hip fracture cases did not significantly change during first social lockdown (March 16th to May 31st 2020) in Austria, except a decreased fracture rate in female patients aged 50–69 years.
Keywords: COVID-19, lockdown, epidemiology, hip fracture, Austria

10

Incidence and mortality risk after pelvic fracture in Austria, 2010–2018

Martina Behanova[1], Judith Haschka[1], Berthold Reichardt[2], Hans-Peter Dimai[3], Jochen Zwerina[1], Roland Kocijan[1,4]*

[1] Ludwig Boltzmann Institute of Osteology at Hanusch Hospital of OEGK and AUVA, Trauma Centre Meidling, 1st Med. Dept. Hanusch Hospital, Vienna, Austria; [2]Austrian Social Health Insurance Fund, Österreichische Gesundheitskasse, Eisenstadt, Austria; [3]Division of Endocrinology and Diabetology, Department of Medicine, Medical University of Graz, Graz, Austria; [4]Sigmund Freud University Vienna, School of medicine, Metabolic bone diseases unit, Vienna, Austria

Objectives: Pelvic fractures (PF) are related to osteoporosis and represent a serious individual and socioeconomic burden.
Patients/Methods: We examined age and sex standardized incidence rates of PF, rates of all-cause overall and one-year mortality among patients with PF, and comparison of mortality between PF patients and a matched fracture-free cohort. Patients ≥50 years old in Austria hospitalised with PF in 2010–2018 and their dates of death were recorded.
Results: A total of 59,085 patients aged ≥ 50 years sustained 59,150 pelvic fractures between 2010 and 2018. Out of these patients 17,569 (29.7 %) were men with an average age of 72.1 years (SD 12.0) and 41,516 (70.3 %) were women with an average age of 78.7 years (SD 10.6). Between 2010 and 2018 the standardized incidence rates of PF increased in both sexes. For men it increased by 31.4 %, from 128.3 to 168.6 per 100,000 and for women by 14.6 % from 223.1 to 255.6 per 100,000. The men-women annual incidence ratio decreased over time from 1.7 to 1.5. One-year post-PF mortality rate was higher in men than in women (13.2 % and 11.3 % respectively, $p < 0.001$). Pelvic fractured patients had elevated mortality hazard (HR 1.27, 95 % CI 1.25–1.29, $p < 0.001$) compared to controls. Adjustment for comorbidities decreased the mortality risk (HR = 0.87, 95 % CI = 0.85–0.88, $p < 0.001$).
Conclusions: There is a clear increase in incidence of PF in the aged population, with a higher increase in men over time. Men revealed higher excess mortality after PF than women.
Key words: pelvic fracture, epidemiology, osteoporosis, mortality, Austria

11

Biomechanische Eigenschaften eines Fadenankersystems aus humaner allogener mineralisierter Knochenmatrix

Jakob E. Schanda[1,2,3], Philipp R. Heuberer[4], Christian Muschitz[5], Christian Fialka[1], Johannes Grillari[2,3]*

[1]AUVA Traumazentrum Wien, Standort Meidling, Wien, Österreich; [2]Ludwig Boltzmann Institut für Experimentelle und Klinische Traumatologie, Wien, Österreich; [3]Austrian Cluster for Tissue Regeneration, Wien, Österreich; [4]healthPi Medical Center, Wien, Österreich; [5]Krankenhaus der Barmherzigen Schwestern Wien, II. Medizinische Abteilung, Vinforce Study Group, Wien, Österreich

Hintergrund: Fadenanker aus humaner allogener mineralisierter kortikaler Knochenmatrix (biologische Fadenanker) gehören zu den neuesten Entwicklungen in der Orthopädie und Traumatologie. Ziel dieser Studie war die Beschreibung der biomechanischen Eigenschaften des biologischen Fadenankers und sie mit einem herkömmlichen metallischen Fadenanker (MFA) und einem bioresorbierbaren Fadenanker (BFA) zu vergleichen.
Methodik: Zunächst wurde die Knochenmikroarchitektur von insgesamt 12 frisch gefrorenen menschlichen Humeri von sechs Spendern mittels highresolution peripheral quantitative computed tomography (HR-pQCT) untersucht. Insgesamt wurden 18 biologische Fadenanker, 9 MFA und 9 BFA alternierend an drei Positionen innerhalb des Tuberculum majus implantiert (Position 1: anterior, Position 2: zentral, Position 3: posterior). Das maximale Versagen der Fadenankersysteme wurde in uniaxialer Richtung bei 135° gemessen.
Resultate: Die maximale Belastung war für biologische Fadenanker höher als für MFA und BFA, ohne statistische Signifikanz zu erreichen. Die Verteilung der Versagensarten (maximale Belastung bis zum Versagen, Fadenriss, Ankerbruch) war signifikant unterschiedlich zwischen den drei Fadenankersystemen ($p < 0{,}001$). Die maximale Belastung bis zum Versagen wurde bei biologischen Fadenankern in allen Fällen erreicht, bei MFA in 44,4 % und bei BFA in 55,6 %. Ein Fadenriss wurde in 55,6 % für MFA und in 22,2 % für BFA beobachtet. Ein Ankerbruch wurde ausschließlich bei BFA (22,2 %) beobachtet. Es wurde keine Korrelation zwischen Knochenmikroarchitektur und Versagensraten der drei Fadenankersysteme gefunden.
Schlussfolgerungen: Der biologische Fadenanker zeigte vergleichbare biomechanische Eigenschaften wie der MFA und der BFA. Darüber hinaus stellt der biologische Fadenanker aufgrund seiner Eigenschaften eine vielversprechende Alternative zu konventionellen Fadenankern dar, die das Einwachsen in den Knochen und die Heilung der Enthese verbessern könnte.
Schlagwörter: Rotatorenmanschettenruptur, Rekonstruktion, biologische Fadenanker, Knochenmikroarchitektur, Biomechanik

12

Teriparatide after 38 months of treatment still effective and safe: a case report

C. Starchl, K. Amrein, H. P. Dimai, A. Fahrleitner-Pammer

Division of Endocrinology and Diabetes, Department of Internal Medicine, Medical University of Graz, Graz, Austria

Background: Treatment with teriparatide (TPTD) is limited to 24 months according to current guidelines. So far, no data exists on safety and efficacy for extended treatment duration. The current case report shows the effect of a 38-month TPTD treatment in a now 73-year-old woman with post-menopausal osteoporosis, following radial fracture, symphysis fracture and two vertebral fractures, despite antiresorptive therapy. Due to less administrative barriers for head physician authorization on her TPTD prescription during the COVID-19 pandemic the patient received the treatment for more than 3 years.
Methods: Case report.
Results: The patient's laboratory findings showed immaculate results (see Table 1) with still high bone turnover and no additional fractures occurred. Bone mineral density changes are remarkable (see **Fig. 1**), the therapy was well-tolerated and the patient had clinically improved. The bone scan was normal. These findings suggest that TPTD is safe and effective even after an exceeded treatment duration of 38 months.
Conclusio: We report the effect of the first known case of long-term treatment with TPTD on bone mineral density, fractures and bone metabolism in a patient with postmenopausal osteoporosis. Due to safety issues, the limitation to 24 months of treatment is still out of the question but according to our results, respondence to therapy was still excellent despite exceeding treatment duration, as shown in laboratory results and bone densitometry. Even in a patient with multiple fractures, the 38-month-treatment with TPTD was able to prevent from further fractures, the patient improved clinically and did not want to stop her anabolic treatment. Unintentional prolonged therapy with TPTD for 14 months proved to still have anabolic effects and most importantly, is safe. Therefore, in some cases, patients may benefit from exceeded treatment or from being given a second cycle of TPTD throughout their osteoporosis therapy.

13
Longitudinale Evaluation des Serum-Phosphatspiegels nach intravenöser Eisenapplikation

Alexandra Struppe[1], Jakob E. Schanda[2,3,4], Andreas Baierl[5], Heinrich Resch[1], Christian Muschitz[1]*

[1]Krankenhaus der Barmherzigen Schwestern Wien, II. Medizinische Abteilung, Vinforce Study Group, Wien, Österreich; [2]AUVA Traumazentrum Wien, Standort Meidling, Wien, Österreich; [3]Ludwig Boltzmann Institut für Experimentelle und Klinische Traumatologie, Wien, Österreich; [4]Austrian Cluster for Tissue Regeneration, Wien, Österreich; [5]Universität Wien, Institut für Statistik und Operations Research, Wien, Österreich

Hintergrund: Bei Eisenmangelanämie besteht ein Zusammenhang zwischen intravenöser Eisensubstitutionstherapie und Hypophosphatämie. Es wird angenommen, dass das Ausmaß der Hypophosphatämie von dem verabreichten Präparat abhängt. Wir stellten die Hypothese auf, dass die intravenöse Verabreichung von Eisen(III)-Carboxymaltose und Eisen(-III)-Sucrose-Komplex zu einer unterschiedlichen Anpassung des Serumphosphatspiegels nach 2, 4 und 12 Wochen führt.
Patienten/Methodik: Zwanzig Patientinnen und Patienten wurden in zwei Studiengruppen randomisiert (Gruppe 1: Eisen(III)-Carboxymaltose, $n=10$; Gruppe 2: Eisen(III)-Sucrose-Komplex, $n=10$). Die Serumwerte aller Patientinnen und Patienten wurden vor intravenöser Eisensubstitutionstherapie sowie 2, 4 und 12 Wochen nach Medikamentengabe erhoben. Primäres Studienziel war die longitudinale Auswertung der Serumphosphatwerte nach Eisensubstitutionstherapie mit Eisen(III)-Carboxymaltose sowie Eisen(III)-Sucrose-Komplex. Sekundäres Studienziel war die Untersuchung von Kalzium, 25-Hydroxyvitamin D, intaktem Parathormon, Prokollagen Typ 1 aminoterminales Propeptid (P1NP), beta-CrossLaps (CTX), Hämoglobin (Hb), Eisen, Ferritin und der Transferrinsättigung.
Ergebnisse: Zwei Wochen nach Medikamentenverabreichung wurden zwischen beiden Studiengruppe signifikante Unterschiede des Phosphat ($p<0{,}001$) und des Ferritin ($p=0{,}011$) beobachtet. In Gruppe 1 war der mediane Serum Phosphatspiegel unterhalb des therapeutischen Referenzwertes. Vier Wochen nach Medikamentengabe wurden nach wie vor signifikante Unterschiede zwischen beiden Studiengruppen für Phosphat ($p=0{,}043$) und Ferritin ($p=0{,}032$) festgestellt. Zwölf Wochen nach Medikamentengabe wurden keine Unterschiede sämtlicher Serumwerte zwi-

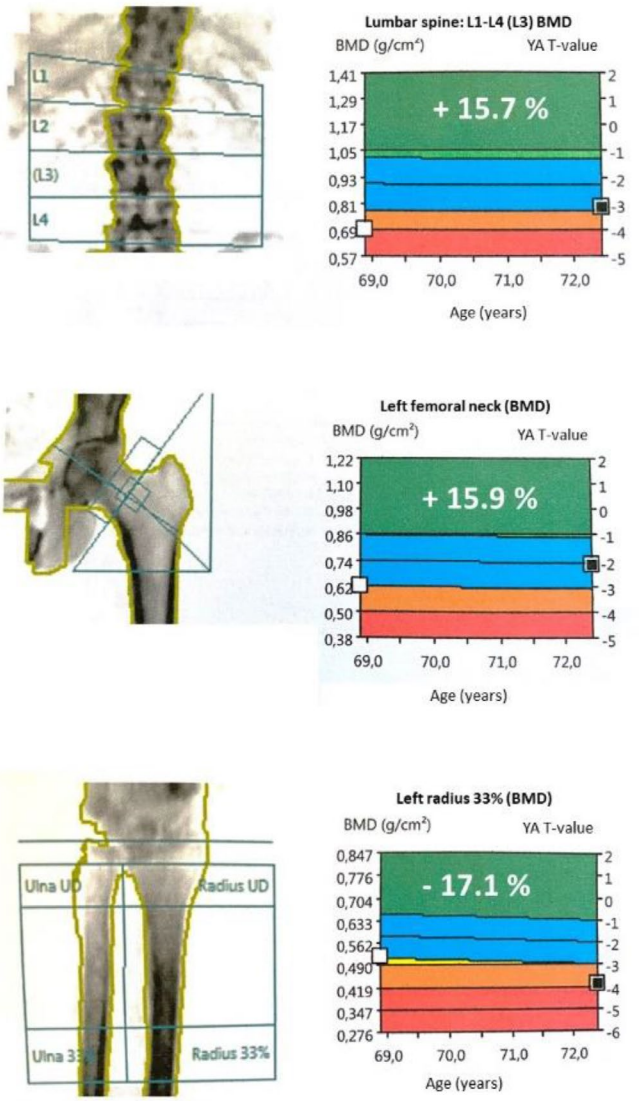

Fig. 1 | 12 ▲ BMD changes over 38 months

Table 1 | 12 Laboratory results and bone measurements at the time of 0, 2, 12 and 38 months

	0	2	12	38	Δ% to baseline
iPTH (pg/mL)	40	20	21	14	–65
Osteocalcin (ng/mL)	17	94	114	80	+471
P1NP (ng/mL)	37	231	253	156.3	+422
β-CTX (ng/mL)	0.36	0.97	1.67	1.6	+444
TBS	1185	–	–	1247	+5
25(OH)D (ng/mL)	46	36	41	37	–20
T-score hip left	–3.0	–	–2.7	–2.2	+27
T-score lumbar spine	–4.0	–	–3.1	–3.1	+22.5
T-score radius left	–2.7	–	–4.2	–4.9	–181

schen beiden Studiengruppen festgestellt. Der Hb-Wert lag zwölf Wochen nach Eisensubstitutionstherapie in beiden Studiengruppen innerhalb des therapeutischen Bereichs.
Schlussfolgerungen: Die intravenöse Eisensubstitutionstherapie führte bereits zwei Wochen nach Medikamentengabe zu signifikanten Veränderungen der Serum-Phosphat- und Ferritinspiegel mit vorübergehender Hypophosphatämie. Auch vier Wochen nach der Behandlung waren diese Veränderungen des Serum Phosphat- und Ferritinspiegels noch zu beobachten. Zwölf Wochen nach Medikamentengabe wurden keine Unterschiede zwischen beiden Studiengruppen beobachtet.
Schlagworte: Hypophosphatämie, Eisensubstitution, Phosphat, Prokollagen Typ 1 aminoterminales Propeptid (P1NP), beta-CrossLaps (CTX)

14
Adherence to anti-osteoporotic drugs during COVID-19-pandemic in Austria

Theresa Stockinger[1,2,3], Martina Behanova[1], Berthold Reichardt[4], Judith Haschka[1,2], Heinrich Resch[3,5], Jochen Zwerina[1,2], Roland Kocijan[1,2,3]*

[1] Ludwig Boltzmann Institute of Osteology at Hanusch Hospital of OEGK and AUVA, Trauma Center Meidling, 1st Med. Dept. Hanusch Hospital, Vienna, Austria; [2]Hanusch Hospital Vienna, 1st Medical Department, Vienna, Austria; [3]Sigmund Freud University Vienna, School of medicine, Medical Faculty of Bone Diseases, Vienna, Austria; [4]Austrian Social Health Insurance Fund, Österreichische Gesundheitskasse, Eisenstadt, Austria; [5]St. Vincent Hospital Vienna, 2nd Department of Internal Medicine, Vienna, Austria

Objectives: The aim of the study was to assess the adherence of patients to oral and parenteral anti-osteoporotic agents during the Covid-19-pandemic 2020.
Patients/Methods: This study was a nationwide retrospective register-based observational study which included all patients in Austria aged ≥50 who received at least one prescription for anti-osteoporotic drugs between January 2018 and November 2020. Pseudonymized individual-level patients' data were obtained from social insurance authorities and the Federal Ministry of Labour, Social Affairs, Health and Consumer Protection in Austria.
Anti-osteoporotic agents were divided into: (i) oral bisphosphonates, (ii) intravenous bisphosphonates, (iii) selective estrogen receptor modulators (SERMs), (iv) teriparatide (TPTD) and (v) Denosumab (DMAB).
We compared the mean number of prescriptions per months from March to November 2020 to the two years prior the COVID-19-pandemic.
Results: There were 1,772,944 dispensing of anti-osteoporotic drugs by 319,155 patients between 2018–2020 (252,403 women (79.1 %, mean age 75.6, SD 10.8) and 66,752 men (20.9 %, mean age 73.4, SD 11.7)). The mean monthly prescriptions for oral bisphosphonates (–16.9 %), intravenous bisphosphonates (–7.1 %) and SERMs (–9.9 %) decreased during COVID-19-pandemic. The dispensing for teriparatide (–2.8 %) during COVID-19, was comparable to 2018 and 2019. The prescriptions for DMAB decreased during the first lock-down in March and April 2020 (24 %), however increased by 8.8 % for the total observation time.
Conclusions: Especially the prescription of oral anti-osteoporotic agents decreased during the COVID-19 pandemic. The observed decrease of DMAB during the first lockdown, was compensated in the following months. Further examinations will include the fracture incidence during COVID-19 in Austria.
Key words: COVID-19, anti-osteoporosis therapy, lockdown, osteoporosis, Austria

15
Circulating miRNAs respond to treatment with Denosumab after two years in women with postmenopausal osteoporosis–the MiDeTe-study

Zora Messner[1], David Carro-Vazquez[2], Judith Haschka[3], Matthias Hackl[2], Heinrich Resch[1,4], Christian Muschitz[1], Peter Pietschmann[5], Jochen Zwerina[3], Roland Kocijan[3,4]*

[1] St. Vincent Hospital Vienna, 2nd Department of Internal Medicine, Vienna, Austria; [2]University of Natural Resources and Life Sciences Vienna (Department of Biotechnology) and TAmiRNA GmbH, Vienna, Austria; [3]Ludwig Boltzmann Institute of Osteology at Hanusch Hospital of OEGK and AUVA, Trauma Centre Meidling, 1st Med. Dept. Hanusch Hospital, Vienna, Austria; [4]Sigmund Freud University Vienna, School of medicine, Metabolic bone diseases unit, Vienna, Austria; [5]Medical University of Vienna–Institute of Pathophysiology and Allergy Research, Vienna, Austria

Objectives: Bone specific microRNAs (miRNAs) play a pivotal role in bone metabolism. The aim of the project was to investigate circulating miRNAs as biomarkers for treatment monitoring.
Patients/Methods: Postmenopausal women ($n = 21$) with the indication for denosumab (DMAB) treatment were included in the study. Bone specific circulating miRNAs in the serum were measured at baseline and months 3, 6, 12, 18 and 24. In the discovery phase, next-generation sequencing (NGS) was carried out to screen miRNA levels at three time points. 24 miRNA candidates with significant regulation ($p < 0.05$) were selected and measured by reverse transcription quantitative polymerase (RT-qPCR) chain reaction to confirm the findings in the entire cohort.:
Results: After 12 and/or 24 months of DMAB, 7 out of 24 miRNAs by RT-qPCR showed significant up- or downregulations compared to baseline. The top candidates were miR-454-3p ($p < 0.001$) and miR-26b-5p ($p < 0.01$). Bone mineral density (BMD) at the hip (+5.5 %, $p = 0.0006$) and lumbar spine significantly increased (+11.4 %, $p = 0.017$), C-terminal cross-linking telopeptide of type I collagen (CTX; –64.1 %, $p < 0.0001$) and procollagen type I N propeptide (P1NP; –69.3 %, $p < 0.0001$) significantly decreased after 24 months of treatment. The Delta changes of miR-454-3p and miR-26b-5p were positively correlated to BMD gain at the lumbar spine ($R = 0.39$; $p = 0.023$ and $R = 0.18$; $p = 0.3$ respectively) and hip ($R = 0.5$; $p = 0.002$ and $R = 0.31$; $p = 0.064$ respectively) and negatively to CTX ($R = –0.66$, $p < 0.0001$ and $R = –0.61$, $p < 0.0001$respectively) and P1NP levels ($R = –0.43$, $p = 0.00072$ and $R = –0.46$, $p = 0.00.018$ respectively).
Conclusion: DMAB-treatment leads to up-regulations of bone specific miRNAs. These changes are associated to BMD gain and could therefore be predictive for treatment response.
Keywords: postmenopausal osteoporosis, microRNAs, denosumab, bone metabolism, bone turnover

16
Fractal-based analysis of bone microstructure in Crohn's Disease: a pilot study

Daniel Arian Kraus [1,2], Judith Haschka [1,2], Martina Behanova [2], Stephanie Huber [1,2], Johann Bartko [1,2], Jakob E. Schanda [3,4], Philip Meier [5], Arian Bahrami [6], Shahin Zandieh [6], Jochen Zwerina [1,2] and Roland Kocijan [1,2,7]*

[1]1st Medical Department, Hanusch Hospital, 1140 Vienna, Austria; [2]Ludwig Boltzmann Institute of Osteology, Hanusch Hospital of OEGK, AUVA Trauma Center Vienna-Meidling, Vienna, Austria; [3]Department of Trauma Surgery, AUVA Trauma Center Vienna-Meidling, Vienna, Austria; [4]Ludwig Boltzmann Institute for Experimental and Clinical Traumatology, Vienna, Austria; [5]ImageBiopsy Lab., Vienna, Austria; [6]Department of Radiology and Nucelar Medicine, Hanusch Hospital Vienna, Vienna, Austria; [7]Medical Faculty of Bone Diseases, Sigmund Freud University, Vienna, Austria

Background: Crohn's disease is associated with bone loss and increased fracture risk. The TX-Analyzer™ is a new fractal-based technique assessing bone microstructure based on conventional radiographs. We evaluated bone microstructure of the thoracic and lumbar spine by TX-Analyzer™ in

Crohn's disease patients and controls and correlated outcome parameters to standard imaging techniques.
Patients/Methods: 39 Crohn's disease patients and 39 age- and gender-matched controls were analyzed. The parameters bone structure value, bone variance value and bone entropy value were measured at the vertebral bodies of T7 to L4 out of lateral radiographs. Furthermore, bone mineral density and trabecular bone score by dual energy X-ray absorptiometry were correlated to them. Crohn's disease patients were further divided into subgroups according to history of glucocorticoid treatment >3 months, disease duration >15 years and history of bowel resection.
Results: Bone structure value and bone variance value of the thoracic spine of Crohn's disease patients were higher compared to controls ($p = 0.016$, $p = 0.012$). Bone entropy value was significantly lower in Crohn's disease patients with glucocorticoid treatment >3 months ($p = 0{,}015$) and disease duration >15 years ($p = 0.001$) at the thoracic spine and with history of bowel resection at the lumbar spine ($p = 0.011$), with no differences in bone mineral density between both subgroups. Additionally, trabecular bone score was reduced in patients with glucocorticoid treatment >3 months ($p = 0.014$).
Conclusion: Despite a not severely pronounced bone loss in this population, impaired bone quality in Crohn's disease patients with well-known risk factors for systemic bone loss was assessed by TX-Analyzer™.
Keywords: Crohn's disease, TX-Analyzer™, fractal-based analysis, bone microstructure, bone loss

Autorenverzeichnis