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Induction of Osteoporosis by Ovariectomy in Adult Albino Rats

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Abstract

Objectives: To evaluate the deterioration of bone tissue in the ovariectomized adult albino rat, as a model of postmenopausal osteoporosis.

Data Sources: Medline databases (PubMed, Medscape, Science Direct) and all materials available in the internet from 2009 to 2015.

Study Selection: The initial search presented 11 articles where 5 had inclusion criteria. The articles studied the efficacy of ovariectomy on bone of adult rats.

Data Extraction: If the studies not meet the inclusion criteria, they were excluded.

Data Synthesis: Comparisons were made by structured review with the results tabulated. Each study was reviewed independently and the obtained data were rebuilt in new language according to the need of the researcher and arranged in topics through the article.

Findings: In total 5 potentially relevant publications were included, all were animal studies. The studies indicate the deterioration of bone state following ovariectomy.

Conclusion: Decreased estrogen level following ovariectomy causes osteoporosis.

Keywords: Bone; Estrogen; Osteoporosis; Ovariectomy; Rat

Abbreviations: BMD: Bone Mineral Density; ALP: Alkaline Phosphatase; P: Phosphorus; CA: Calcium

Introduction

Osteoporosis is a progressive bone disease characterized by a decrease in bone mass that leads to an increased risk of fracture. In osteoporosis, the bone mineral density (BMD) is reduced, bone micro architecture deteriorates, and the amount and variety of proteins in bone are altered [1]. The risk of developing osteoporosis increases with age and is four times higher in women than in men. In osteoporosis, the rapid decline in endogenous estrogen production that occurs during menopause results in a significant increase in bone turnover which results in significant bone loss and increased risk for fragility fracture [2]. Ovariectomy is one of the most common surgical operations in women throughout the world. Ovariectomy results in increased rate in bone resorption outweigh the increased rate of bone formation. Consequently, this leads to osteoporosis [3]. The overall objective is to determine the deterioration on bone tissue in the ovariectomized adult albino rat model of osteoporosis.

Materials and Methods

Search Strategy: We reviewed papers on the impact of ovariectomy on osteoporosis from Medline databanks which are (PubMed, medscape and Science Direct) and also materials accessible in the Internet. We used ovariectomy / osteoporosis / bone rat as searching codes. The search was accomplished in the electronic databanks from 2009 to 2015.

Study Selection: All the researches were freely evaluated for addition. They were added if they contented the following criteria:

Inclusion criteria of the published studies:

1. Published in English language.
2. Published in peer-reviewed journals.
3. Focused on osteoporosis.
4. Discussed the relation between osteoporosis and ovariectomy with decreased estrogen.
5. If a study had several publications on definite viewpoints we used the most recent publication giving the most related data.

Data Extraction: If the studies did not achieve the above criteria, they were omitted such as report without peer-review, not within federal studies platform, letters/ comments/ editorials/ news and studies not focused on the effect of ovariectomy on osteoporosis in adult rats.

Quality Assessment: The quality of all the studies was assessed. Important factors included, study design, attainment of ethical approval, evidence of a power calculation, specified eligibility criteria, appropriate controls, and adequate information and specified assessment measures. It was expected that confounding factors would be reported and controlled for and appropriate data analysis made in addition to an explanation of missing data. It was expected that confounding factors would be reported and controlled for and appropriate data analysis made in addition to an explanation of missing data.

Data Synthesis: A designed systematic review was accomplished with the outcomes formulated.

Results

Data Sources

Medline databases (PubMed, Medscape, Science Direct) and Internet from 2009 to 2015.

Search Strategy

In total 11 hypothetically related publications were recognized, 4 of them were gotten from Pub Med, 2 from Medscape and 5 from Science Direct.

Study Selection and Characteristics

In total 11 potentially related publications were recognized, 6 articles were eliminated. A total of 5 studies were included in the review as they were considered suitable by forthright the containment criteria. All were animal researches. The majority of the researchers surveyed the outcomes of ovariectomy on osteoporosis.

Data Extraction

If the researches did not accomplish the above criteria, they were omitted such as commentary without peer-review, not within federal studies platform, letters/ comments/ editorials/ update and researches not concentrated on the effect of ovariectomy on osteoprosis.

The considered publications were assessed to evidence-based medicine (EBM) criteria by means of the classification of the U.S. Preventive Services Task Force & UK National Health Service protocol for EBM in addition to the Evidence Pyramid.

U.S. Preventive Services Task Force:

1. **Level I:** Evidence obtained from at least one properly designed randomized controlled trial.
2. **Level II-1:** Evidence obtained from well-designed controlled trials without randomization.
3. **Level II-2:** Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group.
4. **Level II-3:** Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled trials might also be regarded as this type of evidence.
5. **Level III:** Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Data Synthesis

A designed systematic review was accomplished with the outcomes formulated.

Quality Assessment

Vital issues encompassed, study design, fulfillment of ethical approval, evidence of a force estimation, definite eligibility norms, and suitable controls, enough data and definite assessment manners were evaluate:

Effects of Ovariectomy on Bone Histology

Four studies (Table 1) [4-7] cited that ovariectomy highly deteriorates the histological features of bone with decreased thickness of both compact and cancellous bone together with decreased collagen in bone matrix.

Table 1: Comparison between the selected five studies.

Study	Ghada et al. [4]	Zakaria et al. [5]	Magda [6]	Jinson et al. [7]	Nan et al. [8]
Histological results	After OVX, rats revealed an apparent thinning in the cancellous bone trabeculae which appeared as discontinuous bony ossicles separated by widened bone marrow spaces	Animals in the ovariectomized group showed sparse, uniform thinning of the trabeculae resulting in widening of intertrabecular spaces in the femur head	Thinning of the cortex of femoral bone and formation of multiple cavities	The bone trabeculae of rats in the OVX group were arranged sparsely, were thinner or had disappeared altogether and the remaining connections were incomplete	

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Serum calcium level		Significant decrease in the mean serum calcium level in the OVX group		There was no significant difference in serum Ca level amongst any group	Serum calcium level significantly decreased in OVX control rats
Serum phosphorus level		The mean level of serum phosphorus did not show significant change between the different Studied groups.		There was no significant difference in serum P level amongst any group	Serum phosphorus level significantly decreased in OVX control rats
Serum ALP level		The mean level of serum ALP did not show significant change between the different Studied groups.		ALP was significantly unregulated in the OVX group	Ovariectomy induced high bone turnover in rats, where serum ALP level was increased

Effects of Ovariectomy on Biochemical Markers

Three studies (Table 1) [5,7,8] revealed that ovariectomy causes marked biochemical changes as decreased serum calcium (CA) and phosphorus (P) level together with increased serum alkaline phosphatase (ALP) levels.

Discussion

The present study was achieved to assess the effect of ovariectomy on rat bone. Bone is a dynamic tissue and its metabolism is maintained by a balance between osteoblastic bone formation and osteoclastic bone resorption. If this balance was disturbed, bone mass gradually lost causing osteoporosis [9]. Ovariectomy is the surgical removal of an ovary or ovaries in laboratory animals. In human this operation is called oophorectomy. Ovariectomy has been used as a method to induce estrogen deficiency which is similar to the postmenopausal women in that there is a rapid loss of trabecular bone mass and strength that occur shortly after ovariectomy [10]. The morphological and histological changes in bones of osteoprotic rats after ovariectomy were a result of marked estrogen deficiency and impaired calcium absorption leading to marked resorption of bone with less bone formation causing marked thinning of both cortical and cancellous bony trabeculae with marked trabecular discontinuity [4]. Liu, et al. [11] concluded that decreased estrogen causes increased parathyroid hormone level, which might affect osteoclasts formation and disrupt bone resorption. This was in contrast with the study on the fluoride induced osteoporosis in which there was increased thickening of bone trabeaculae in osteoprotic rats due to increased osteoid formation and bone deposition [12].

Sohair, et al. [13] stated that, following ovariectomy there was serum calcium and phosphorus deficiency caused by decreased calcium absorption and incomplete mineralization of bone, this lead finally to decrease in bone mineral density (BMD). This was caused by hyperparathyroidism secondary to calcium deficiency and exacerbated by estrogen deficiency. Mansur & Wojciech [14] results showed that hypoestrogenism after ovariectomy causes characteristic increase in the bone turnover markers (alkaline and acid phosphatases) in serum of experimental animals. Lack of inhibiting activity of estrogen on osteoclasts caused the increase in acid phosphatase activity and increase in bone resorption. Together with increased resorption processes, bone formation process was also increased by enhancement of osteoblast activity ledding to growth of alkaline phosphatase activity.

Conclusion

Constructed on the results offered, this study proved the deteriorating effect of ovariectomy and estrogen deficiency on bone, causing osteoporosis.

Funding

No Funds.

Conflict of Interest

No Conflict of Interests.

References

1. Hernlund E, Svedbom A, Ivergard M, Compston J, Cooper C, et al. (2013) Osteoporosis in the European Union: medical management, epidemiology and economic burden. Arch Osteoporos 8: 136.
2. Golob AL, Laya MB (2015) Osteoporosis: Screening, Prevention, and Management. The Medical clinics of North America. 99(3): 587-606.
3. He C, Hui R, Tezuka Y, Kadota S, Li J (2010) Osteoprotective effect of extract from achyranthes bidentata in ovariectomized rats. J Ethnopharmacol 127(2): 229-234.
4. Ghada F, Mohamed, Sahar MM, Omar (2010) Light Microscopic and Environmental Scanning Electron Microscopic Study on the Effect of Exercise on Bone Microstructure in Ovariectomized Rats. Egypt J 33(3): 431-440.
5. Zakaria EK, Wafaa I, Rasheed, Tahany R, Elias, et al. (2010) Protective Effect of Either Dietary or Pharmaceutical n-3 Fatty Acids on Bone Loss in Ovariectomized Rats. Maced J Med Sci. 3(1): 9-16.
6. Magda MN (2011) Histological assessment of zoledronic acid (Aclasta) in protection against induced osteoporosis in female albino rats. The Egyptian Journal of Histology 34(1): 129-138.
7. Jinsong W, Jian W, Yan G, Rong Z (2015) Effectiveness of combined salmon calcitonin and aspirin therapy for osteoporosis in ovariectomized rats. Molecular Medicine Reports 12(2): 1717-1726.

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8. Nan L, Lu-Ping Q, Ting H, Yan-Bin W, Qiao-Yan Z, et al. (2009) Inhibitory Effects of Morinda officinalis Extract on Bone Loss in ovariectomized rats. Molecules 14(6): 2049-2061.

9. Jeong, Eun-Sun J, Joong KM, Sang RJ, Kyoung HC, et al. (2015) Wnt3a-Producing Fibroblasts in Ovariectomy induced osteoporosis in a rat model. Tissue Eng Regen Med. 12(5): 306-313.

10. Giro G, Goncalves D, Sakakura CE, Pereira RM, Marcantonio JE, et al. (2008) Influence of estrogen deficiency and its treatment with alendronate and estrogen on bone density around osseointegrated implants: radiographic study in female rats. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 105(2): 162-167.

11. Liu nv, Wu PW, Bringhurst FR, Wang (2002) Estrogen inhibition of PTH stimulated osteoclast formation and attachment. In vitro: involvement of both PKA and PKC. Endocrinology 143(2): 627-635.

12. Czarnowski W, Krechniak j, Urbanska B, Stolarska K, Taraszewska CM, et al. (1999) The impact of water-bone fluoride on bone density. Fluoride 32: 91-95.

13. Sohair RF, Amel MS, Amany AS, Mohamed M (2015) Possible antiosteoporotic mechanism of Cicer arietinum extract in ovariectomized rats. Int J Clin Exp Pathol. 8(4): 3477-3490.

14. Mansur R, Wojciech S (2002) Effect of ovariectomy on biochemical markers of bone turnover (ALP, ACP) and calcium content in rat mandible and teeth bull. Vet Inst Pulawy 46: 281-287.

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