AAOS
American Academy of Orthopaedic Surgeons

Women's Health Issues Advisory Board

# Putting Sex into Your Orthopaedic Practice

Based off the AAOS Now quarterly column of the same name, this exhibit will provide important information for your practice about issues related to sex (determined by our chromosomes) and gender (how we present ourselves as male or female, which can be influenced by environment, families and peers, social institutions, etc.). Specifically, it will address hip fractures, a recognized public health problem in women; but also a significant problem in men. Most research studies on osteoporosis and prevention of future fractures have been conducted on women, and what is known about managing fractures in women may not directly apply to men without modifications that consider sex and gender differences.


## ABSTRACT

**Most research studies on osteoporosis and prevention of future fractures have been conducted on women, and what is known about managing fractures in women may not directly apply to men without modifications that consider sex and gender differences. This exhibit with regard to hip fractures will:**

1. Analyze the current state of research related to sexual dimorphism.
2. Consider risk factor differences between men and women
3. Consider differences in co-morbidities
4. Review differences in operative treatment choices
5. Discuss the role of genetics, specifically any sexual dimorphism in the COL I protein and
6. Consider differences in the contribution of estrogen /estrogen receptors with regard to risk of hip fracture.


**Introduction**:
As recently reported in *AAOS Now* and The Journal of the American Geriatrics Society, mortality for the elderly is increasing after hip fracture and men are increasing sustaining hip fractures. Up to now, most studies regarding hip fractures have focused on female patients, as osteoporosis leading to hip fracture is more common in postmenopausal women and is a clear risk factor for hip fracture. Moreover, more women sustain hip fractures than men, although as previously noted, men are fracturing more now than in the past.

Another new finding showed that mortality for both genders was higher in patients treated with hip arthroplasty than in those treated with osteosynthesis. With new information such as this, and more research including more men, other new findings may be forthcoming. Presently one thing is clear: differences exist for men and women both in anatomy, risk factors, and morbidity and mortality after hip fracture. For example, it is known that the following exists:

1. Traditionally, femoral neck fractures have been reported to occur at an average age 77 years for women and 72 years for men. As new information emerges, the age from one study was found to be increased to **79.1 years for men and 81.7 years for women**.

2. Femoral neck fractures are much more common in elderly women.

3. The fracture rate doubles for each decade of life after the fifth decade.

4. The rate of occurrence of hip fracture is highest in white women, followed by white men, black women and finally black men.

5. The ratio of intertrochanteric fractures to femoral neck fractures increases with age in both white and black women.

6. Some data in men indicate that the ratio of intertrochanteric to femoral neck fractures appears to be stable across all ages for both whites and blacks.

7. Osteoporosis plays a role in both the etiology of femoral neck fractures and the ability of internal fixation devices to provide stability and healing.

8. Mortality and morbidity: Mortality is higher for **men** at one year after a hip fracture generally because physiologically, they have secondary risk factors that exist contributing to their mortality which is left undiagnosed until hip fracture is sustained.

9. Late segmental collapse after a femoral neck fracture has healed is the collapse of the subchondral bone and cartilage that overlies the infarcted bone. It generally happens later than avascular necrosis. It is reported as higher in **women**.

While the above facts are well known and reported in the literature, gender specific reasons and causes are not always referred to. This exhibit investigated potential sex and gender specific references, reasons for differences and if information is available in the literature regarding these sex and gender specific differences.

**Hypothesis**: Hip fractures, a public health problem in women and increasingly more so in men, are presented in the literature primarily as a sex and gender specific event, namely involving women.

**Materials and Methods: A 2007 Medline search covering the past twenty years (1987-present) was conducted identifying the following with regard to hip fractures:**

1. Consider risk factor differences between men and women who sustain a hip fracture;
2. What are the differences in co-morbidities in those with a hip fracture;
3. What are the operative treatment differences in management of hip fracture;
4. What is the potential role of genetics, specifically any sexual dimorphism in the COL I protein; and
5. Is there a contribution of estrogen /estrogen receptors with regard to risk of hip fracture.

**A brief preliminary literature search on each above item was individually reviewed.** The number of research papers related to gender was noted.

**Results**: citations were available for the following:

1. **Analyze the current state of research related to sex and gender differences:** New information regarding the influence of sex and gender on musculoskeletal health appeared in JBJS 2005 by Tosi, Boyan and Boskey. According to their article, this subject of sex and gender could be found in 533 articles from basic science to genetics and epidemiology. In this very thorough article, hip fracture was mentioned regarding women only and in the specific context of the risk of hip fracture to the daughter of a woman who sustained a hip fracture. No mention of men and hip fracture was contained in this cutting edge article on sex and gender in musculoskeletal health. Page 1636 Articles cited: 533.

2. **Differences in co-morbidities:** Search #2 "gender differences in hip fracture" resulted in 27 articles with 5 citations per article.

3. **Operative choice differences in treatment management women:** In search #3, "differences in men and women with regard to operative treatment of hip fractures". 44 articles were cited with 5 related articles listed after the primary citation. 42 articles had men included as subjects; all 44 articles had women included with 2 articles addressing only women with hip fracture and operative choices.

4. **Role of genetics, specifically any gender dimorphism in the COL I protein:** Search #4 Is hip fracture genetic? Resulted in 19 citations with 5 related link to each citation. 16 papers included women, with 10 papers including only women. 6 papers included men

5. **Consider differences in the contribution of estrogen /estrogen receptor with regard to risk of hip fracture:** 35 primary citations that included estrogen in the citation were obtained with 5 related articles sorted per primary citation. However, when the search was limited to estrogen receptors and hip fracture, only 2 citations were listed. One study involved both men and women, one study involved only women.

| TOPIC | CITATIONS | MEN | WOMEN |
|---|---|---|---|
| **General Sexual Dimorphism** | **533** subject collections<br>**168** citations (general topic) | **0** men | **1** women |
| **Gender Differences in Co-Morbidities** | **27** | **24** (3 men only ) | **24** (3 women only) |
| **Operative Choice Differences** | **44** | **42** | **44** (2 women only) |
| **Genetics and Hip Fracture** | **19** | **6** (2 men only) | **16** (10 women only) |
| **Estrogen Receptors and Hip Fracture** | **2** | **1** | **2** |

**Conclusion**: Some facts regarding hip fractures are well known. Historically, studies in the literature predominantly included white women. This literature search demonstrated an increase in the inclusion of men. However, the "Genetics and Hip Fracture" category was still dominated by studies on women. This improved inclusion of men in hip fracture studies has advanced our understanding of sex and gender specific risks and can improve patient care.

## The best care for patients is sex and gender specific care!

**Discussion:**
With the rise in healthier lifestyles and people living longer, more men and women of all races with live longer. With longer life, the risk of hip fracture increases. It is reasonable to predict that hip fractures will continue to increase unless more research and gender specific care and preventative measures are begun earlier in a person's life. Mortality and co-morbidities in men are greater when compared to women. This may be attributed to men having more undiagnosed co-morbidities before they sustain a hip fracture (men are younger and sicker). Best care for a patient would be sex and **gender specific care** to optimize early return to function and a return to expected quality of life. Examples include:

1. Attention to secondary causes of osteoporosis (greater in number of co-morbidities in **men**), and osteoporosis (greater in **women**).
2. Appropriate attention to prevention of future subsequent fractures.
3. Psychosocial factors (ex. depression is greater in both **men and women** who sustain a hip fracture, but most research has been on **women**).
4. Use of pharmacologic agents for treatment of osteoporosis before and after hip fracture (most treatment options have been recommended for **women**).
5. Prevention of mortality after hip fracture (greater in **men**: diagnose and treat co-morbidities early).

**Sources:**
Orwig, DL; Chan, J; Magaziner, J. Hip Fracture and Its Consequences: Differences Between Men and Women. *Orthopaedic Clinics of North America.* 2006; 37: 611-622.

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Tosi LL; Boyan BD; Boskey AL. Does Sex Matter in Musculoskeletal Health? *Journal of Bone and Joint Surgery (The Orthopaedic Forum).* July 2005: Vol. 87-A, No. 7: 1631-1647.

Vestergaard, P, et al. Has Mortality After a Hip Fracture Increased? *Journal of the American Geriatrics Society.* November 2007; Vol. 55, No. 11: 1720-1726.

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