



## RESEARCH ARTICLE

## Breast Injury in USA Female Water Polo Athletes

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### Abstract

**Objective:** Water polo is a very physical and aggressive sport and injury data for male water polo athletes is well established. However, the data is scarce for women. Given that a recent study identified that almost half (47.9%) of female collegiate athletes experienced a breast injury during participation in basketball, soccer, volleyball, and softball, it warrants the investigation of the prevalence of female breast injuries during participation in water polo. The purpose of this study was to report the prevalence and reporting of breast injury during participation on the USA Women's Water Polo Team.

**Design:** Descriptive research design utilizing an anonymous cross-sectional questionnaire consisting of 12 questions about various aspects of any sports related breast injury history. This was emailed to the 18 members of the USA Women's Water Polo Team.

**Setting/participants:** 18 members of USA Women's Water Polo Team were emailed a questionnaire, 16 responded.

**Results:** Response rate was 88.9%. Exactly half (8/16) of the athletes reported that they sustained a breast injury, and 62.5% (5/8) of those that had an injury indicated having at least 6 or more injuries to their breast. None of the women informed a medical professional about their breast injury.

**Conclusions:** The prevalence of breast injuries in elite female water polo players in this study (50%) and lack of informing medical professionals about their injuries is consistent with previously published breast injury rates in a study of collegiate athletes. These findings should be used to heighten the awareness of the prevalence of breast injury in female athletes. Continued research into possible sequela of these injuries is warranted.

### Introduction

Over 214,000 women participate in collegiate athletics in the United States (US) and the number of water polo athletes in the US continues to rise. There are over 45,000 nationwide members of USA Water Polo (USAWP), more than 500 USAWP membership clubs, 1,216 female collegiate water polo athletes, and 61 women's collegiate teams recognized by the National Collegiate Athletic Association (NCAA) in 2018 [1].

It is not uncommon for athletes to sustain an injury during sport participation. Water polo is a very physically demanding and aggressive sport that has considerable underwater contact, much of which is unnoticeable. Water polo injuries for male and female players vary from shoulder, dental, head/face, knee, elbow, hand/wrist, ear, eyes, spine, hip and ankle [2-13]. Injury data for male water polo athletes is well established in the literature; however, the data is scarce for women.

A recent study identified that almost half (47.9%) of female collegiate athletes experienced a breast injury during participation in basketball, soccer, volleyball, and softball [14]. Given the aggressive nature of participation in water polo play, awareness to common injuries sustained by women in this sport is needed. Therefore, a gap exists in understanding the prevalence of female breast injuries during participation in water polo. The purpose of this paper is to report the prevalence of breast injury during participation in water

polo in one Elite Women's Water Polo Team.

## Materials and Methods

### Study design

The design consisted of a cross-sectional questionnaire. The questionnaire's content validity was established by three experts in survey research not involved with the study.

### Participants

Participants were female water polo players that were recruited from the USA Women's Water Polo Team. All participants provided informed consent and the study was approved by a University Institutional Review Board (IRB).

### Procedures

An invitation to participate in the study was sent via e-mail to the USA Women's Water Polo Team. The questionnaire had 12 questions which included demographic information and questions about their sports related breast injury history, including injury reporting, severity, treatment, participation, and protective equipment.

### Statistical analyses

Statistical software (SPSS version 23) (SPSS Inc., Chicago, Illinois) was used to determine the prevalence (primarily expressed in percentages) of self-reported breast injuries in female water polo players during their career.

## Results

Eighteen female USA Water Polo athletes were sent the questionnaire. Sixteen responded for an 88.9% response rate. The mean age was 23.5-years-old. Exactly half (8/16) of the athletes reported that they sustained an injury to their breast during water polo play on the survey. It must be noted that 62.5% (5/8) of the athletes that indicated having an injury to their breast reported having more than 6 separate breast injuries. The women with 6 or more injuries commented on the nature of their injuries. Bruising and discoloration, scratches, redness from being kicked, elbowed, or hit with the ball were commonly reported. One athlete had 4 separate injuries, one athlete had 3 injuries, and one athlete had 2 separate breast injuries. None of the women informed a medical professional about their breast injury.

## Discussion

To our knowledge this is the first study to examine breast injuries sustained during participation in water polo. The findings from this study clearly demonstrate that female water polo players sustained breast injuries as indicated by 50% (8/16) reporting one or more injuries. A comparison of the prevalence of breast injuries in female professional water polo players in this study

(50%) is consistent with previously published breast injury rates in a study of collegiate athletes participating in soccer, basketball, volleyball, and softball (47.9% (93/194)) [14]. Short term sequela of breast injury in this study is comparable to the study conducted by Smith, et al. (2018) where female athletes reported bruising and discoloration following breast trauma [14].

Breast injuries during water polo sport play may be explained by the aggressive and high level of physical contact involved in the sport. Previous reports of water polo injuries highlight the frequency and incidence that injuries occur in this aggressive sport, however information on breast injury is completely void. Players are at risk for traumatic injuries due to foul play and intense physical contact that often occurs undetectable below the surface of the water [12]. Additionally, in this study, bruising due to contact with another player or the ball were commonly noted. To combat the aggressive nature of this sport, players are required to wear caps and mandatory "nail checks" are performed to assure nails are not sharp enough to cause lacerations and other injuries [12]. Non-mandatory and occasionally worn [6] protective equipment available to water polo players include mouth guards, ear guards and non-sharp eyewear [12]. In summary, protective equipment for water polo players are exclusive to the head and, subsequently, cannot reduce the risk of injury to other parts of the body during aggressive sport play. This highlights the need for preventative injury measures during water polo competition, such as specific protective equipment for the breast. In a previous study of female collegiate athletes who self-reported an injury to the breast, roughly 2% report wearing protective equipment for the breast beyond a normal sports bra [14].

It must be noted that 62.5% (5/8) who reported a breast injury during water polo participation also reported having more than 6 separate breast injuries. As previously stated, this is not surprising given the aggressive and high contact nature of the sport. This highlights the importance not only of the need for preventative measures, but for documentation of the injuries and providing the appropriate follow up and/or treatment. In the aforementioned study of breast injury in female collegiate athletes, less than 10% reported the injury to a medical professional, and only 2.1% received treatment for their injury [14]. This highlights the need for educating female athletes who participate in high contact sports, such as water polo, on the need for reporting any breast injury so that any necessary treatment can be obtained as well as any necessary follow up. Additionally, given the limited amount of protective equipment worn during water polo, healthcare providers must be aware of the unique injuries that accompany this aggressive and physically demanding sport.

## Perspective

Based on this study, breast injuries in female water polo athletes are seemingly under-reported to medical professionals, as are breast injuries in collegiate athletes participating in other sports [14]. Less than 10% of female athletes actually report breast injuries to medical professionals and even less receive any form of treatment. Water polo athletes do not wear any breast protective equipment [14]. The long-term effects of breast injuries sustained during participation in athletics are unknown. However, it has been stated that fat necrosis can develop after a breast injury causing persistent pain [15]. Heightened awareness and reporting of breast injuries sustained during athletic participation, especially for high contact and/or aggressive sports is needed. Breast health education of the female athlete and injury management should be a priority of sport related medical professionals and coaches. There also needs to be a comprehensive approach to breast health of the modern-day female participating in athletic activity so that prevention and detection of breast injury/trauma will occur.

## Limitations and Recommendations for Future Research

A limitation of this study is the data is representative of elite athletes retrospectively reporting their breast injuries during water polo play and the results may not be generalizable to other elite sports. It would be beneficial for future research to explore if significant long-term sequela exist following breast injuries sustained during participation in water polo, especially given the aggressiveness and extremely high contact nature of the sport. Furthermore, there is a need for further study of female breast injury during sport participation, including reporting mechanisms and protective equipment.

## Conclusion

The prevalence of female breast injury during water polo play is alarming, with almost 50% of a women's team indicating that they have had an injury, and with 62.5% sustaining 6 or more breast injuries. None of these injuries were reported to a medical professional. The data presented in this paper should be used as a benchmark to heighten the awareness and education needed in the management of breast health in female athletes. This is of extreme importance for female athletes who participate in high contact and aggressive athletic competitions.

## Main Points

This study highlights the substantial prevalence of breast injury sustained during participation in water polo and the lack of disclosure to medical professionals. Almost 50% of this women's elite water polo team reported on the survey that they sustained a breast injury, of those, 62.5% reported sustaining 6 or more

breast injuries. Future research should be conducted to explore long term sequela of breast injuries sustained in sport play and standardized reporting methods for women who participate in aggressive contact sports.

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## Contributors

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## References

1. National Collegiate Athletic Association (2018) Sport Sponsorship, Participation and Demographics Search.
2. Brooks JM (1999) Injuries in water polo. *Clin Sports Med* 12: 313-319.
3. Colville JM, Markman BS (1999) Competitive water polo. *Clin Sports Med* 18: 305-312.
4. Franic M, Ivkovic A, Rudic R (2007) Injuries in water polo. *Croat Med J* 48: 281-288.
5. Hams A, Evans K, Adams R, Waddington G, Witchalls J (2019) Epidemiology of shoulder injury in sub-elite level water polo players. *Phys Ther Sport* 35: 127-132.
6. Hersberger S, Krastl G, Kuhl S, Filippi A (2012) Dental injuries in water polo, a survey of players in Switzerland. *Dent Traumatol* 28: 287-290.
7. Mountjoy M, Junge A, Alonso JM, Engebretsen L, Dragan I, et al. (2010) Sports injuries and illnesses in the 2009 FINA world championships (aquatics). *Br J Sports Med* 44: 522-527.
8. Mountjoy M, Junge A, Benjamin S, Boyd K, Diop M, et al. (2015) Competing with injuries: Injuries prior to and during the 15<sup>th</sup> FINA world championships 2013 (aquatics). *Br J Sports Med* 49: 37-43.
9. Mountjoy M, Miller J, Junge A (2019) Analysis of water polo injuries during 8904 player matches at FINA world championships and Olympic games to make the sport safer. *Br J Sports Med* 53: 25-31.
10. Rod E, Ivkovic A, Boric I, Jankovic S, Radic A, et al. (2013) Acute hyperextension/valgus trauma to the elbow in top-level adult male water polo goalkeepers: a cause of osteochondritis dissecans of the capitellum. *Injury* 44: S46-S48.
11. Sallis RE, Jones K, Sunshine S, Smith G, Simon L (2001) Comparing sports injuries in men and women. *Int J Sports Med* 22: 420-423.
12. Stromberg JD (2017) Care of water polo players. *Curr Sports Med Rep* 16: 363-369.
13. Zamora-Olave C, Willaert E, Montero-Blesa A, Riera-Punet N, Martinez-Gomis J (2018) Risk of orofacial injuries and mouthguard use in water polo players. *Dent Traumatol* 34: 406-412.

14. Smith LJ, Eichelberger TD, Kane EJ (2018) Breast injuries in female collegiate basketball, soccer, softball, and volleyball athletes: Prevalence, type and impact on sports participation. *Eur J Breast Health* 14: 46-50.
15. Maffulli N, Longo UG, Gougoulias N, Caine D, Denaro V (2011) Sports injuries: a review of outcomes. *Br Med Bull* 97: 47-80.
16. United States of America Water Polo (USAWP) (2018) USA Water Polo Introduces 6-8 Sports at Olympic Development Program Camp This Weekend.
17. United States of America Water Polo (USAWP). USA Water Polo Announces 2016 U.S. Olympic Women's Water Polo Team.
18. Sircar T, Mistry P, Harries S, Clarke D, Jones L (2010) Seat-belt trauma of the breast in a pregnant woman causing milk-duct injury: A case report and review of the literature. *Ann R Coll Surg Engl* 92: 14-15.
19. Madden B, Phadtare M, Ayoub Z, Chebl RB (2015) Hemorrhagic shock from breast blunt trauma. *Int J Emerg Med* 8: 83.
20. Akkas BE, UcmakVural G (2013) Fat necrosis may mimic local recurrence of breast cancer in FDG PET/CT. *Rev Esp Med Nucl Imagen Mol* 32: 105-106.
21. Jansen DA, Stoetzel RS, Leveque JE (2002) Premenarchal athletic injury to the breast bud as the cause of asymmetry: Prevention and treatment. *Breast J* 8: 108-111.
22. Ducis I, Zakaria HM, Felder JM, Fantus S (2014) Nerve injuries in aesthetic breast surgery: Systematic review and treatment options. *Aesthet Surg J* 34: 841-856.
23. Sanders C, Cipolla J, Stehly C, Hoey B (2011) Blunt breast trauma: Is there a standard of care? *Am Surg* 77: 1066-1069.