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Breast Injuries in Female Collegiate Basketball, Soccer, Softball and Volleyball Athletes: Prevalence, Type and Impact on Sports Participation

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ABSTRACT

Objective: In 2015-2016, over 214,000 female athletes competed at the collegiate level in the United States (U.S.). The National Collegiate Athletic Association (NCAA) collects injury data; however, breast-related injuries do not have a specific reporting category. The exact sequelae of breast injury are unknown; however, a relationship between breast injury and fat necrosis, which mimics breast carcinoma, is documented outside of sports participation. Breast injuries related to motor vehicle collisions, seatbelt trauma, and blunt trauma have been reported. For these reasons, it is important to investigate female breast injuries in collegiate sports. The objectives of this study are to report the prevalence of self-reported breast injuries in female collegiate athletes, explore injury types and treatments, and investigate breast injury reporting and impact on sports participation.

Materials and Methods: A cross-sectional study of female collegiate athletes at four U.S. universities participating in basketball, soccer, softball, or volleyball. Main outcome measure was a questionnaire regarding breast injuries during sports participation.

Results: Almost half of the 194 participants (47.9%) reported a breast injury during their collegiate career, less than 10% reported their injury to health personnel with 2.1% receiving treatment. Breast injuries reported by breast injuries reported by sport include softball (59.5%), basketball (48.8%), soccer (46.7%), and volleyball (34.6%).

Conclusions: The long-term effects and sequelae of breast injuries reported by female collegiate athletes during sport play are unknown. Nearly 50% of participants had a breast injury during sports activities. Although 18.2% indicated that breast injury affected sports participation, only 9.6% of the injuries were reported to medical personnel with 2.1% receiving treatment.

Keywords: Chest injury, breast trauma, sport injury

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Introduction

In 2015-2016, there were over 214,000 women competing in collegiate athletics in the United States and this number continues to rise (1). The exact sequelae of breast injury are unknown; however, a relationship between breast injury and fat necrosis, which can mimic breast carcinoma in manual exams and/or ultrasound and mammogram findings, has been documented outside of sports participation (2-6). Fat necrosis can occur following trauma to the breast, leading to persistent and sometimes painful masses in the breast (7). Breast injuries related to motor vehicle collisions and resultant blunt breast trauma with the seat belt (3-5, 8-11) and breast blunt trauma as a result of a fall (11-12) have been reported; however, only one study has been found that explored female breast injury during competitive sports participation (13). For these reasons, it is important to investigate the prevalence, reporting, treatment and implications of female breast injuries in collegiate sports. The primary purpose of this study is to report the prevalence of self-reported breast injuries in female collegiate athletes. A secondary purpose is to explore the injury reporting, the severity and type of breast injury. The treatment of breast injuries including the impact of breast injury on sports participation in female collegiate athletes was also explored.

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Materials and Methods

Study Design: Cross-sectional. The questionnaire's face value was established by three experts in survey research methodology not involved in the study and the questionnaire was piloted on a subset of participants.

Subjects: Participants included female collegiate athletes over the age of 18 who were currently participating on a sanctioned basketball, soccer, softball, or volleyball sports team during the 2015-16 season. These teams were selected because they were identified by the primary researchers as popular women's sports. All the participants provided written consent and the study was approved by an ethics committee, University of Michigan-Flint Institutional Review Board (IRB), prior to recruitment. Twenty-six schools representing the National Collegiate Athletic Association (NCAA), National Association of Intercollegiate Athletics (NAIA), and Mid-America Intercollegiate Athletics Association (MIAA) universities from four different states were invited via email and telephone to participate in this study. Four schools agreed to participate in this study, 13 schools declined, and nine did not respond. The IRB guidelines for data collection were also completed at each of the four institutions where data were collected. For the four schools represented in this study, there were seven male and three female athletic trainers. Once approved by the IRB, an invitation to participate in the study was sent via e-mail to university coaches and was posted for the athletes with the day and time of data collection.

Procedures: On the day of data collection, one of the primary researchers of the study met with the athletes who were potentially interested in participating in the study in a room at their university. Those who attended were given the informed consent form and the questionnaire, and those who wished to participate completed both forms. The paper-based 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 Package for Social Sciences (SPSS) version 23 (SPSS Inc., Chicago, IL, USA) was used to determine the prevalence of self-reported breast injuries in female collegiate athletes during their collegiate career.

Results

A total of 194 female collegiate athletes participated in this study. There was no indication why athletes elected to participate in the study or not. Participants represented basketball, soccer, softball, and volleyball as their primary sport (Table 1). The mean age was 19.3 years. Although almost half (47.9%) of the athletes reported a trauma/injury to their breast during their collegiate career, less than 10% of all the injured females reported their injury to an athletic trainer, coach, physician, team captain or other person and 2.1% reported having received treatment for their injuries.

Breast injuries were the most prevalent (59.5%) among softball athletes. The reported injuries ranged in severity: ten women with mild injuries, eight with moderate injuries, six having abrasions or scrapes, seven with bruising or discoloration, three with swelling and three with scar tissue development. Only 4.6% of the injuries were reported with two athletes not specifying whether they did or did not report their injury to a healthcare professional. Three athletes reported that their play was affected, but only one of them received treatment for swelling. The treatment received for this injury was ice. No athletes reported missing any trainings or competitions. (Table 2).

Table 1. Survey Responses by Sport and Institution

	Institution A		Institution B		Institution C		Institution D		
Sport	Roster Size	Responses n (%)	Roster Size	Responses n (%)	Roster Size	Responses n (%)	Roster Size	Responses n (%)	Total Response Rate
Basketball	11	11 (100%)	-	-	30*	30 (100%)	-	-	100%
Soccer	22	18 (81.8%)	23	23 (100%)	28	28 (100%)	24	21 (87.5%)	92.8%
Softball	16	6 (37.5%)	18	15 (72.2%)	-	-	20	16 (80%)	68.5%
Volleyball	14	3 (21.4%)	-	-	16	16 (100%)	14	7 (50%)	59.1%

*Institution C had two teams, a varsity and a junior varsity, which were combined here for the response rate.

Table 2. Breast Injury Results by Sport

Sport	Total participants per sport (n)	Number of individuals injured n (%)	Total number of injuries n (%)	Reported injury n (%)	Injury affected play n (%)	Wearing protective equipment n (%)	Received treatment n (%)
Basketball	41	20 (48.8%)	50	1 (5%)	5 (25%)	0	1 (2.4%)
Soccer	90	42 (46.7%)	113	2 (4.8%)	5 (11.9%)	1 (1.1%)	0
Softball	37	22 (59.5%)	34	4 (18.1%)	3(13.6%)	1 (2.7%)	1 (2.7%)
Volleyball	26	9 (34.6%)	55	2 (22.2%)	4 (44.4%)	0	0
Total	194	93 (47.9%)	252	9 (9.6%)	17 (18.2%)	2 (2.1%)	2 (2.1%)

Breast injuries were the second most prevalent (48.8%) among basketball athletes. Of the breast injuries, one was considered to be severe, nine were moderate and two were mild. Eight of these injuries had subsequent bruising and three had swelling of the breast tissue. One athlete reported bruising of her breast and received an unspecified treatment but did not miss trainings or competitions. Three of the participants did not specify whether they reported their injury to a healthcare professional. (Table 2)

A similar percentage (46.7%) in soccer athletes indicated on the questionnaire a history of breast injury. Of these injured players, 25 reported mild injuries, 11 reported moderate injuries and two reported severe injuries with 16 reporting bruising or discoloration and four with scar tissue developing following the injury. Of these injuries, two were reported, four did not specify if they reported their injury or not, and none of the athletes received treatment. None of the injuries resulted in missing trainings or competitions. (Table 2)

Approximately one-third of volleyball athletes (34.6%) indicated breast injury; seven of the injuries were mild, two were moderate, five of them reported bruising or discoloration and two reporting swelling. Two of these injuries were reported and one athlete did not state whether they reported their injury to a healthcare professional or not. Four of the injuries affected play or competition and none of the athletes received any types of treatment or resulted in missing trainings or competitions. (Table 2)

Participants (97.8%) who experienced a breast trauma/injury reported not wearing any protective breast/chest equipment beyond normal bra/support worn during daily activities when the breast trauma/injury occurred. Approximately 18.2% of the participants who sustained an injury indicated that their participation or performance in trainings or competitions was affected by mild or moderate pain. Of the two athletes who received treatment for their injuries, only one received follow-up care/instruction for ice treatment (softball athlete) and the other respondent (basketball) did not specify.

Discussion and Conclusion

The results from this study indicate that 47.9% of all the female collegiate athletes in this study experienced a breast injury during sports participation during their collegiate career, yet research specific to sports-related breast injuries in females is limited, making it difficult to capture the prevalence and sequelae of these injuries (7, 14-30). In this study, there was relatively no association (less than 10%) between the number of women who sustained a breast injury (n=93) and the number of women who reported the injury to a healthcare professional (n=9), which is a reason for concern. A previous report on collegiate athletes found that when reporting gender-specific injuries and conditions to their athletic trainer, athletes were more comfortable in reporting and receiving care from those of the same sex (31). Also, at the collegiate level, approximately 30% of athletic trainers are female (32). These factors may contribute to the lack of injury reporting identified in the current study.

In this study, approximately one-third (n=36) of the female athletes who reported breast injury classified their injury as bruising or discoloration and nine reporting swelling. These symptom reports are consistent with previous studies of females who suffered a seat belt injury (3-5, 9, 11) and/or blunt breast trauma (8, 11, 33). In a study of female boxers, nine out of the 61 athletes (14.7%) had signs of fibrocystic breast tissue, two out of 61 had developed breast fibroadenomas and one female had three small cystic lesions (14). Previous reports suggest that traumatic injury to the breast often led to hematomas (3, 4, 8, 11, 12, 33-36). This trauma often led to palpable nodules, months or years following the injury, that were diagnosed as lipid cysts and/or fat necrosis (3, 4, 9, 11, 36). Other studies revealed that breast trauma may be linked to the development of breast cancer (12, 37), breast deformity (10), hematoma with extraversion (8, 36), and breast asymmetries (38). Fat necrosis is a common theme in research and case studies related to breast trauma. Following breast injury, the development of masses or nodules in the breast tissue is common, and may be a sign of fat necrosis (3, 4, 6, 9, 11, 36). Fat necrosis often begins as lipid cysts and can become calcified as time progresses and are often difficult to distinguish from breast carcinoma (36). Fat necrosis has also been linked to chronic pain and anxiety, both affecting the female for months to years following injury (6, 9). Hence there is an obvious need for specific classification, thorough documentation, treatment, and follow-up for females who experience breast injury during collegiate athletics.

In the present study, only two athletes of the 93 injured (2.1%) received treatment for their breast injuries. While the mechanism of injuries reported by participants in this study are different than high velocity seat belt injuries and other traumas, the physiological response to these injuries remains the same, that being contusions, bruising, hematomas, edema and pain. The lack of treatment reported by participants in this study may be concerning because of similar information reported on breast injury resulting from seat belt trauma (3-5, 8-11, 39) including classification systems for breast injury due to seat belt trauma (5, 9) and others for blunt breast trauma (33). Following a seat belt related breast injury, it is recommended that the female have a physical breast exam three-six months post-injury as well as yearly mammograms and breast examinations (9). This is primarily to monitor for complications such as fat necrosis, a possible result of breast trauma, which can mimic the presentation of breast cancer (7). Despite some recommended treatment approaches for blunt breast trauma (9, 33-35) and seat belt injuries (5), previous reports suggest that there is lack of consistency with the standard of care for individuals with blunt breast trauma (33).

Recommendations for the management of breast trauma in adolescents during sports participation include cold application, firm support, and surgical aspiration in the presence of hematoma (35). It is imperative that healthcare professionals distinguish between scar tissue and fat necrosis of the breast tissue and carcinoma of the breast to prevent misdiagnoses of cancer (34). Proper management should include a thorough physical exam as well as mammograms and biopsies as needed (34). The authors of this study recommend that an athlete with a past history of breast trauma report their injury history when getting routine breast exams and mammograms in the future. Information regarding previous breast trauma could be helpful to the physician in interpreting mammograms and determining a diagnosis when fat necrosis is present.

The use of chest protection in female college sports is rare and more exploration is needed. Investigation into other female sports is warranted. This study revealed that only 2.1% of the female college athletes were wearing any type of protection beyond their normal sports bra. Protection is needed at all levels of female sports, including in adolescents. It has been found that in pre-menarchal females, breast trauma can potentially lead to future breast asymmetries during development (38).

Almost 20% of the female athletes who reported a breast injury in this study reported that their performance/participation during sports play was affected by mild or moderate pain; yet none of the injured athletes reported that they did not compete because of their injuries. This finding is most likely explained by the lack of breast injury reporting to a healthcare professional. It is possible that if these injuries were reported, the management of the injury would include time-off from competitive play or modifications to activity.

Participants were informed that they did not have to answer any question that they did not wish to, or that made them uncomfortable, which likely explains any missing responses. Limitations to this study include possible recall bias for the self-reported history of breast injuries. Also, this study included participants representing four sports, which makes it difficult to generalize results to all female college athletes. Additional longitudinal research is needed to investigate reporting systems, training of healthcare professionals that work with female athletes to address specific breast issues, as well as standardization of classification and treatment for sports-related female breast injuries.

In conclusion, the long-term effects and sequelae of breast injuries reported by female collegiate athletes during sport play are unknown. In this study, almost half (47.9%) of the athletes reported a trauma/injury to their breast during their collegiate career, less than 10% of all the injured females reported their injury to a healthcare professional and 2.1% received treatment for their injuries. From a clinical perspective, this information can be used to heighten the awareness related to female breast injuries and encourage healthcare professionals to create an environment that encourages disclosure of injures that may be perceived as personal or embarrassing to discuss.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of the University of Michigan-Flint.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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