Shoulder Injuries In Olympic Weightlifting: A Systematic Review

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Abstract—

Background Olympic Weightlifting is a unique sport with subsequently unique injuries. While data has been collected on other forms of weightlifting and resistance training, data specific to Olympic weightlifting is scarce.

Objective To systematically review the prevalence of shoulder injuries in the sport of Olympic Weightlifting.

Data Sources A keyword search of Cinahl, Medline, Embase, The Cochrane Library, Pubmed, and SPORTDiscus was conducted without a time limit during the preliminary search due to scarcity of injury data.

Study Selection Author assessment using inclusion and exclusion criteria of longitudinal studies and cohort studies

Data Extraction Data specific to research study design, sport, body part, and injury rate was extracted from included papers by both authors. The data was divided into categories within body part and type of injury data tracked by each study.

Data Synthesis A narrative synthesis of the data was used to describe the prevalence of shoulder injuries and other pertinent data found in the respective studies. The methodological quality and risk of bias of the included was assessed using the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. Seven studies met the inclusion criteria. All studies were of either fair or good methodological quality. The findings suggested that 16.9% of total injuries were due to shoulder injuries.

Conclusion This systematic review found that shoulder injuries are a common injury in Olympic Weightlifting. Within each study, shoulder injuries were reported as the most common site of injury followed closely by the low back. However, due to scarcity of literature specific to Olympic Weightlifting, this review should be taken with caution and not be interpreted that shoulder injuries are the most common injury in weightlifting. Future studies should be aimed at high quality longitudinal studies to further investigate injuries according to body region. It is our duty as clinicians and researchers to synthesize better literature for the benefit of the Weightlifting Athlete.

Keywords—Shoulder; Shoulder Injuries; Weightlifting; Olympic Weightlifting

Introduction

Olympic Weightlifting is a unique sport which is quickly growing in popularity in the United States (1,2). This rapid rate of development can be attributed to the work of USA Weightlifting which is the National Governing Body (NGB) of Olympic Weightlifting in The United States (3). As the governing body, it regulates an increasing amount of local and nationally sanctioned weightlifting meets to successfully increase exposure and participation in the sport (3). Other Sport and fitness activities such as CrossFit have also played a large role in the growth of Olympic Weightlifting (4). A typical CrossFit class consists of a strength portion, a skill portion, and the workout of the day (WOD) (5,6). Either the strength or skill portion of the class may involve the full expression of the Olympic lifts or a variation (7). The WOD itself may have Olympic lifting embedded as well (8). The integration of Olympic Weightlifting in CrossFit may serve as an introduction for many participants and athletes into the sport (7). In the Athletic realm, the two Olympic lifts have been incorporated into strength and conditioning programs due to their potent ability to increase vertical power and rate of force production (9,10). A literature review by Serrano and Serrano (2020) found that using the Olympic lifts increase athletic performance by increasing power production in athletes. Other authors have similarly investigated Olympic lifts and their effect on vertical jump and power production with positive effects (12-14).

The sport of Olympic Weightlifting consists of two lifts: The Clean and Jerk and The Snatch (15). The Clean and Jerk is performed by moving the barbell from the ground to the shoulders (Clean) and then moving the barbell from the shoulders to the overhead position (Jerk) (16,17). The Snatch is performed by moving the barbell from the ground to overhead position in one continuous motion (18,19). In the

competition setting, each participant attempts to total their highest combined Snatch and Clean and Jerk with three attempts in each lift (15). Three judges must unanimously score the lift as “Good” for it to be counted (20). Some common errors include “pressing out” by the lifter which means they do not land with their elbows extended and must compensate to straighten out their elbows (20). During the clean portion of the clean and jerk, the athlete may not touch their elbows to their knees, and they may not re-start the first pull of the barbell once it has passed knee height (15). Lastly, lack of stabilization once the barbell is overhead which is expressed through the athlete standing still with the barbell for 2-3 seconds is mandatory(15).

For the sake of clarity, the term Olympic Weightlifting will be used through this systematic review to highlight its independence as a sport. Other forms of weightlifting, such as a powerlifting and resistance training may be confused. Olympic Weightlifting as a training modality for the sake of athletic performance while similar does not truly captivate the sport. There is much injury data on resistance training defined by participating in activity that involves moving external loads (21-23). This allows for the aforementioned methods of all types of resistance training to be included in these studies. Recently, there has been more specific data in the literature by various authors that pools injury data from powerlifting and Olympic weightlifting (24-26). Similarly, there have been pooled cohort studies of injuries reported at Summer Olympic Games that categorizes data based on metrics such as: gender, sport, and event (27-29). While these are helpful insights into Olympic weightlifting specific injuries, they provide heterogenous data with other confounding variables. These confounding variables may skew data specific to the sport of Olympic Weightlifting. For coaches, researchers, and clinicians who work with Olympic Weightlifters it is essential to better understand risk of injury. Using previous data from Calhoon & Fry (1999), it has been found that the lumbar spine (low back), shoulder, and knees suffer the most injuries.

The demands of the sport dictates that athletes must have strong, yet stable shoulders (31,32). As a joint, the shoulder is inherently mobile but not as stable making it the most common large dislocated joint in the body (33,34). Shoulder injuries from instability are associated with soft tissue injuries such as labral injuries and bony injuries to the humeral head (Bony Hill Sachs and Reverse Hill Sachs Lesions) (35,36). And athletes who dislocate/subluxate their shoulder are at higher risk for recurrent episodes as compared to their peers who not had episodes of instability (dislocation/subluxation) (37). Due to the shoulder being a mobile joint, it also relies on the rotator cuff for dynamic stability (38). This reliance on the rotator cuff during the large external loads being lifted predisposes its four muscles to injuries of varying degrees. The more we can understand the occurrence of shoulder injuries specific to the Olympic Weightlifting athlete, the better we can begin addressing corrective exercise, rehabilitation, and strength and conditioning programs. Thus, the purpose of this systematic review is to provide information into the rate of shoulder injuries in Olympic Weightlifting.

Methods

Protocol and Registration

The methodology of the systematic review and meta-analysis was in according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (39).

Data sources and search strategy (Eligibility criteria, Information Sources, Search)

The literature search of databases was conducted in May 2020 and articles listed in Cinahl, Medline, Embase, The Cochrane Library, Pubmed, and SPORTDiscus. It included articles between January 1970 and May 2020 due to the scarcity on the subject. In addition to the online searches, manual references searches for articles were conducted from relevant journals and in various textbooks. The textbooks used for additional sources were those in the field of sports medicine and epidemiology that were thought to have data on the sport of weightlifting and its injuries. From the articles; titles, abstracts, and full texts were screened individually by the two authors (JS and BS). Titles were screened twice to ensure capturing of all relevant data. The authors (JS and BS) also reviewed the abstracts and excluded those that did not meet the inclusion criteria. Full text articles were then reviewed independently by each author. After each article had been screened; their references were also screened for any relevant articles pertaining to general injuries in weightlifting eligible for further review. Articles were included that were agreed upon by both authors (JS and BS). Quality appraisal was used for the included articles as described in the subsequent section. Both authors assessed the studies and compared results after the screening process.

Study selection

One author (JS) used the inclusion criteria to select both general and relevant studies using title and abstracts of the results yielded by the literature search. The second author (BS) performed an independent literature search and applied the same inclusion criteria as (JS) to validate the search strategy and ensure its reliability. Due to the even number of authors on the paper, any uncertainty over the inclusion of the studies from the title and abstract was verified from the full text article or reaching out to the authors on the article in question if possible.

Data extraction and synthesis

The corresponding author extracted and analyzed data from the selected articles that met the inclusion

criteria. The data was grouped for ease of analysis according to the primary objective of the study. For example, many of the articles found described general injury on different forms of weightlifting. This data was first categorized into injuries only in Olympic Weightlifting and subsequently into the body parts in an effort to isolate shoulder injuries. The different injury articles were then grouped and categorized. A narrative synthesis was used to describe the differences between types of weightlifting and different types of injury measures used. A quantitative synthesis (meta-analysis) of the studies was not possible due to the heteroscedasticity of the primary outcome measure (shoulder injuries).

Quality appraisal (Risk of bias)

To assess the quality of each article included into this systematic review, a combination of validated scales were used. Using the work set forth by Whitney et al. (1998) and Higgins et al. (2005) for observing quality was used when appropriate (40,41). The primary tool used to measure study quality was the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies. Both authors assessed the studies individually and compared results after. Every article received a total score according to the assessment tool (poor, fair, or good).

Results

The search strategy resulted in 5,030 potentially relevant articles. A total of 70 abstracts and full text articles were selected for author review. Of the articles screened and reviewed, 7 studies met the inclusion criteria.

Study characteristics

Using the inclusion criteria, a total of 862 Olympic weightlifters were quantified in this study. Of the various demographics available for analysis, the authors decided that experience, age, gender, and competition level would be relevant as done in the systematic review by Aasa et al. (2016) (42). All articles included were classified as: descriptive epidemiological studies (Junge et al., Kulund et al) (43, 44), Prospective studies (Engebretsen et al., Jonasson et al.) (45,46), Cross-sectional (Raske et al.) (47), and Retrospective (48). A challenge when performing the quantitative analysis of the included articles was injury reporting style. For example, (Junge et al.) (43) use total injuries reported while Raske et al. (2002) (47) use injury rates and injury exposure hours. The studies by Junge et al. (2009) (43) and Engebretsen et al. (2013) (45) document the injuries experienced by all athletes from sports at the 2008 and 2012 Summer Olympic Games, respectively. Raske et al. (47) track shoulder injuries specifically in the population of Olympic weightlifters (50 Male, 5 Female) and Powerlifters. This study was unique because original data was captured in 1995 while a larger follow-up cohort was tracked in 2000. This new cohort added 55 new Olympic Weightlifters (50 Male, 5 Female). Calhoon and Fry (1999) (30) collected injury data in a cohort of resident Olympic Weightlifters at the United States Olympic and Paralympic Centers (referred to then at USOC). Their cohort consisted of 27 male weightlifters tracked over a 6-year time period. Kulund et al. (1978) (43) tracked injury from 80 weightlifters with various amounts of experience about their injuries although descriptive data on the cohort is not available. Jonasson et al. (2011) (45) looked at a cohort 75 male athlete from various sports to quantify joint-related pain in the extremities and spine. The varying qualities of these studies deemed nominal groups for total injuries and shoulder injuries necessary for measure of the primary outcome.

Weightlifting

While there were articles in this study that analyzed other sport and types of injuries, we limited our data analysis to shoulder injuries in Olympic Weightlifting. The studies by Junge et al. (2009) (43) and Engebretsen et al. (2013) (45) document injuries experiences by athletes in all sports and disciplines included in Summer Olympic Games. Calhoon and Fry (1999) (30), Kulund et al. (1978) (44) provide useful data because it is captured from a homogenous weightlifting population. Jonasson et al. (46) captures data from elite athletes among some of which are Olympic Weightlifters similar to how Raske et al. (47) captures data from both Powerlifters and Olympic Weightlifters.

Localizations of injuries

The purpose of this review was to quantify the prevalence of shoulder injuries within Olympic Weightlifting, thus this review only included articles with mention of shoulder injuries.

Types of injuries

Ideally, injuries would have been categorized into specific types. In overhead sports, labral injuries, shoulder instability, and rotator cuff pathology are common. Being able to analyze this on the sub-group level would have been very valuable, the authors had to settle with the broad classification of “shoulder injury”. It is noted that the works by Junge et al. (2009) (43) and Engebretsen et al. (2013) (45) do try to establish categories (sprains, strains, time lost in competition, etc.). Of the 1384 total injuries reported, 235 were shoulder injuries (16.9%).

Quality Assessment (Poor, Fair, Good)

Using the Quality Assessment Tool of Observational Cohort and Cross-Sectional Studies, the seven included articles were rated. It was found that 4 studies met the Good classification and 3 studies met the Fair classification.

Discussion

Of the total number of injuries reported in this systematic review, 16.9% were found to be shoulder injuries. Due to the scarcity of literature on injuries in Olympic Weightlifting, injuries were searched for in

similar activities. Due to the increasing popularity of weightlifting in CrossFit and strength and conditioning programs, this paper searched in these topics for comparison purposes. Elkin et al. (2019) performed a cohort study consisting of 411 participants in two groups of CrossFit participants (n=122) and Olympic Weightlifting (n=289) and found that participants in the CrossFit group were 1.30 times more likely to be injured (95% CI, 1.075-1.57; P=.0067) (49). More importantly, Elkin et al. (2019) found that shoulder injuries were the most common complaint in both groups (46.41%) (49). Similarly, Lavallee and Balam (2010) explored different styles of strength training while summarizing acute, chronic, and velocity-based injuries (50). Lavallee and Balam (2010) identify that injury to the shoulder complex may occur during the Jerk and Snatch (50). They also find that lower back injuries are more common in Olympic and Powerlifters as compared to Bodybuilders. Stone et al. (1994) findings are similar (51). The literature in using strength training a general term in which Olympic Weightlifting falls under is plentiful. An epidemiological study by Keogh and Winwood (2017), they analyzed 20 studies and used injury rate as the primary outcome measure (52). Keogh and Winwood (2017) found the shoulder to be among the top five location of injuries (6-36%) (52). They put forth the idea this high rate of injury may occur partly due to high amount of compressive loads to a traditional non-weight bearing joint. Also, the end-range external rotation seen in the transition from shoulder to overhead in the Jerk and the turnover phase of the Snatch may contribute to shoulder injury similar to how the terminal cocking phase during the throwing motion is a mechanism of injury for the anterior labrum (52). A systematic review between Powerlifters and Olympic Weightlifters found that shoulder injuries were the most commonly injured anatomical location followed by the low back and then elbow (Aasa et al., 2016) (26). To expand on the findings by Junge et al. (2009) (43) and Engebretsen et al. (2013) (45), the article by Soligard et al. (2017) looking at sports injury and illness incidence at the 2016 Summer Olympic Games was explored (53). The findings in this study were hard to quantify because each sport was only represented by a horizontal bar graph which estimated 15% of Weightlifting athletes reported with injury (53). Weightlifting specific papers seem to agree with our findings regarding the commonalities of shoulder injuries in Olympic Weightlifting. Alabbad and Muaidi (2016) found the shoulder to be the most common location of injury (36%) in their literature review (54).

Limitations

There are several limitations noted in this paper. Due to the even number of authors involved in this systematic review, the information decided on may have been biased. Although Olympic Weightlifting is a growing sport, it is still relatively small in the United States, and literature seems to compile strength training as a singular activity. This made data extraction and analysis difficult because of inclusion of different sports and injury reporting in different ratios (total injuries, types of injuries, injury exposure). Lastly, the different type of studies makes compiling the results have lower accuracy.

Conclusions

Shoulder injuries seem to be the most common injury in the sport of Olympic Weightlifting. It is important to understand and note that Olympic Weightlifting is an independent sport. Thus, while including CrossFit and strength and conditioning programs may be more feasible, it adds confounding variables which may skew data. It seems that shoulder injuries in Olympic Weightlifters may range from 6-36% with our systematic review finding 16.9%. This systematic review should be used as a guide for researchers, coaches, and clinicians when working with this specific population. Researchers may use this paper to understand the gap that exists in this field and perform higher quality studies. Coaches and clinicians should collaborate in regard to load management, injury prevention management, and technique audits for the benefit of working with Weightlifting athlete now having a better understanding of the shoulder injury prevalence.

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