Gymnastics and Concussions:

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OBJECTIVES:

1. Explore the association of concussion symptom presentation and gymnastic event injured on
2. Examine if pre-existing depression, anxiety, migraine, or learning disorders affected the symptom burden or symptom durations of gymnasts following a concussion
3. Evaluate the characteristics of those who returned to the clinic for a new injury after returning to gymnastics

INTRODUCTION:

4 Events in Women's Artistic Gymnastics:

- Vault
- Uneven Bars
- Balance Beam
- Floor Exercise

6 Events for Men's Artistic Gymnastics

- Floor Exercise
- Pommel Horse
- Still Rings
- Vault
- Parallel Bars
- Horizontal (high) Bar.

The incidence of injury in gymnastics ranges from 1.08-50.3 per 1,000 hours of exposure

Concussions in gymnastics may be caused by:

- Mismatch between the ability of the gymnast and the skill level attempted
- Lack of supervision

Common ways gymnasts sustain concussions include:

- Hitting his/her head on an event/apparatus or mat when performing a skill
- Blow to the head by his/her own body part.

METHODS:

- Retrospective chart review (10 years)

Inclusion:

- Males and Females
- 6-22 years old
- Sustained concussion while participating in gymnastics (practice or competition)
- Diagnosed with a concussion by sports medicine physician

Statistical analysis:

- One-way ANOVAs and follow-up independent samples t-tests, using Bonferroni adjustments to control for type I error were used
- Sample t-tests were used to compare those who reported depression, anxiety, migraine, or learning disorders prior to the concussion to those who did
- Statistical significance was defined as a p value < 0.05.
- All statistical analyses were conducted using Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 24.0, Armonk, NY: IBM Corp).

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RESULTS:

- 201 charts were assessed to identify potential patients
- 62 patients met inclusion for the study
- 94% were female
- Loss of consciousness occurred in 20% of the cases
- No association between the type of event where the patient was injured and PCSS score upon initial clinical visit
- Those who reported pre-existing depression, anxiety, migraine, or learning disorders did not report significantly higher PCSS scores, longer symptom resolution times, or longer return to play times
- 13 gymnasts returned to the clinic for a subsequent injury after their concussion
    - 6 which were sustained during gymnastics and 7 which were not

Table 1: Patient Characteristics

Patient Characteristics	
Continuous Variables	Mean (SD)
Age (years)	14.4 (2.4): range= 7 – 20
Time from injury-clinic presentation (days)	30.5 (35.2): range= 1 – 186
Symptom resolution time (days); n=20	57.6 (76.5): range= 4-370
Return to play time (days); n=31	102.5 (138.1): range= 13-792
Symptom severity (PCSS score)	30.1 (22.9): range= 0-97
Categorical variables*	N (%)
Sex (female)	58/62 (94%)
History of concussion	21/59 (36%)
LOC at time of injury	11/57 (19%)
Amnesia at time of injury	8/27 (30%)
Placed in neck brace at time of injury	4/12 (33%)
History of anxiety	5/53 (9%)
History of depression	1/52 (2%)
History of migraines	1/53 (2%)
History of ADD/ADHD	4/54 (7%)
History of learning disorder	5/55 (9%)
Event in which they were injured (n)	Floor: 20 Beam: 12 Bars (uneven, high, or unspecified): 11 Vault: 7 Rings: 3 Not identified: 3 Mat: 2 Ball: 1 Foam pit: 1 Trampoline: 1 Conditioning: 1
Level of gymnastics (n)	Level 4: 2 Level 7: 3 Level 8: 5 Level 9: 5 Level 10: 3 Level 11: 1 College: 1 Junior Olympics: 1 Not listed: 41

DISCUSSION:

- At this point we cannot determine if there is one specific event more prone to concussion injuries
- Having a history of ADD/ADHD, depression, anxiety or migraines do not affect symptom presentation or resolution time
- Uneven bars had a higher incidence of concussion
- 33% were placed in cervical collar at time of injury

Table 2. PCSS score upon initial clinical presentation by event injured on

Injury Event Type	PCSS Score Mean (SD)	95% CI
Floor	32.7 (26.7)	19.4 – 45.9
Beam	24.8 (24.8)	10.1 – 39.6
Bars	35.3 (23.5)	18.5 – 52.1
Vault	26.0 (9.9)	15.6 – 36.4
Other	28.7 (23.6)	11.8 – 45.6

Table 3. Patient characteristics of those seen for an injury sustained after concussion

Patient	Sex	Age	Time from concussion – second injury (days)	Type of injury	Setting of injury
1	Female	7.7	1456	Concussion	Other sport
2	Female	11.4	528	Concussion	Gymnastics
3	Female	12.1	720	Concussion	Other sport
4	Female	13.2	117	Patellofemoral friction syndrome	Gymnastics
5	Female	13.7	382	Daily headaches; no trauma	Other sport
6	Female	13.9	1211	Right partial ACL sprain	Non-sport
7	Female	13.9	58	Concussion	N/A
8	Female	14.3	425	Hamstring strain and concussion	Gymnastics
9	Female	14.6	1	Concussion	Non-sport
10	Female	14.7	223	Concussion	Non-sport
11	Female	14.7	252	Ankle sprain	Gymnastics
12	Female	15.3	189	ACL tear	Gymnastics

CONCLUSION:

Concussions occur during gymnastics. There was no statistically significant difference in gymnastics events and concussions. Future studies need to include larger databases that are prospective, and focus on injury prevention strategies.

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