

Cardiovascular Screening Practices and Attitudes From the NCAA Autonomous “Power” 5 Conferences

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Background: The development of athlete-specific electrocardiogram (ECG) interpretation standards, along with recent rates of sudden cardiac death (SCD) in athletes being higher than previously estimated, has heightened the debate in the sports medicine community regarding cardiovascular screening of the college athlete, including whether certain high-risk subsets, such as male basketball athletes, should undergo more intensive screening.

Hypothesis: ECG and/or echocardiography screening in National Collegiate Athletic Association Autonomous 5 Division I (A5DI) schools will be more common than previous reports, and there will be more frequent use of noninvasive cardiac screening for men’s basketball players than the general athlete population.

Study Design: Cross-sectional, quantitative study.

Level of Evidence: Level 4.

Methods: The head team physician for each of the 65 schools in the A5DI conferences was contacted to complete an anonymous survey regarding cardiovascular screening practices at their institution. The survey inquired about current screening protocols, whether SCD epidemiology (SCD-E) was considered in establishing those practices, and whether awareness of present epidemiology altered physician attitudes toward screening.

Results: A total of 45 of the 65 team physicians (69%) responded. All schools reported performing history and a physical evaluation. While 17 (38%) perform only history and physical, 26 (58%) also include an ECG, and 12 (27%) include echocardiography for all student-athletes. Specifically for male basketball athletes, 10 (22%) schools perform only history and physical, 32 (71%) include ECG, and 20 (45%) include echocardiography. Additionally, 64% reported using SCD-E in developing their screening protocol. Those that had not considered SCD-E indicated they were unlikely to change their screening protocol when presented with current SCD-E.

Conclusion: The majority (62%) of A5DI institutions include ECG and/or echocardiography as part of their cardiovascular screening of all athletes, increasing to 78% when specifically analyzing male basketball athletes.

Clinical Relevance: A5DI institutions, presumably with greater resources, have largely implemented more intensive cardiovascular screening than just history and physical for all student-athletes and specifically for men’s basketball—the athlete group at greatest risk.

Keywords: sudden cardiac death; athletes; sports; men’s basketball; prevention; electrocardiogram

Sudden cardiac death (SCD) in a collegiate athlete is a devastating event. Once thought to be exceedingly rare, 10-year epidemiological data from the National Collegiate

Athletic Association (NCAA) published in 2015 demonstrated an overall annual incidence of SCD in college athletes of 1 in 53,703.^{13,14} Several subgroups were identified with a higher

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incidence; most notably, the group at highest risk is Division I men's basketball players, with an annual incidence of 1 in 5200.^{13,14}

There has been significant debate in the sports medicine community about the best cardiovascular screening practices to prevent SCD. Current American Heart Association screening recommendations include a 14-point history and physical examination, but no additional testing unless indicated.¹⁸ Several organizations, including the International Olympic Committee and European Society of Cardiology, support inclusion of an electrocardiogram (ECG) in the screening process.^{3,16} The NCAA has provided guidance for schools using ECG in their screening protocol but has not recommended universal ECG screening of student-athletes.¹²

A survey of college team physicians completed in 2012 demonstrated that 78% of responding schools performed only history and physical (70% in Division I schools), with the other schools also including noninvasive cardiac screening (NICS), consisting of ECG and/or echocardiography (ECHO), in their screening protocol.⁷ Another survey of head athletic trainers from Division I football programs in 2011-2012 reported that 53% of programs performed history and physical only, with the remaining including NICS.²¹

The purpose of this study was to examine the current cardiovascular screening practices within the Autonomous 5 Division I (A5DI) schools (ie, Atlantic Coast Conference, Big 12 Conference, Big Ten Conference, Pac-12 Conference, and Southeastern Conference), including whether different protocols are used for subpopulations with different SCD risks based on sex, race, or sport. Team physician attitudes toward using SCD epidemiology (SCD-E) when establishing screening protocols were also investigated.

METHODS

After obtaining institutional review board approval, an anonymous online questionnaire was uploaded into Qualtrics software (www.qualtrics.com) for data collection.

Participants

Team physicians in A5DI schools were surveyed. There are 65 institutions in the A5DI conferences. The team physician best suited to respond to the cardiovascular screening practices at each institution (eg, head team physician) was identified and sent a request to participate in the study via email. Only 1 physician per institution was contacted between June 7 and July 29, 2016. Nonresponders received 2 additional requests to participate during the study period.

Instrument

The questionnaire consisted of 10 items (see Appendix 1, available in the online version of this article) covering 3 areas of interest: (1) current cardiovascular screening practices, (2) whether current SCD-E was considered in establishing those practices, and (3) whether the awareness of SCD-E statistics altered physician attitudes toward screening.

Participants were contacted electronically, receiving information about why they were chosen to participate in this project, the rationale of the study, incentives for participation, and the survey link. Amazon gift cards were available for some participants who chose to provide their email address at the end of the survey, chosen via a random drawing. Survey responses were kept anonymous; email addresses that participants entered for the gift card drawing were not linked to their survey responses.

Data Analysis

Capturing descriptive information (eg, central tendencies) about the sample was the goal of quantitative data analysis. Therefore, descriptive statistics for each of the variables of interest were generated. Frequencies and percentages were generated for categorical variables. Differences in screening practices for all athletes compared with male basketball athletes in responding schools were analyzed using the chi-square test. A *P* value <0.05 was considered statistically significant.

Qualitative data analysis was completed to reduce the overall data pool. Where appropriate and necessary, the data from the data entry questions were analyzed through thematic analysis (eg, coding and establishing themes). Two raters examined the data, and interrater agreement reached 100%.

RESULTS

A total of 45 of the 65 A5DI institutions (69%) responded. The frequency of respondents from each conference, the percentage of the total sample represented by each conference, and the percentage of schools represented within each conference are shown in Table 1.

Current Screening Practices

All schools reported performing preparticipation history and physical on all student-athletes, but 62% also reported performing NICS in the general student-athlete population, including ECG (58%) or ECHO (27%). For male basketball athletes, schools reported a higher rate of NICS, with 71% including ECG and 45% including ECHO (Table 2 and Figure 1). Although NICS was more commonly reported for men's basketball, the differences between the percentage of responding schools that use only history and physical for male basketball athletes compared with all student-athletes was not statistically significant (odds ratio, 2.11; *P* = 0.17).

The conference with the greatest percentage of schools including ECG in their protocols for all student-athletes and men's basketball specifically was the Atlantic Coast Conference (89% in both cases), while the conference with the lowest percentage was the Big Ten (38% and 50%, respectively). The Big 12 had the greatest percentage of schools reporting use of ECHO for all student-athletes and men's basketball specifically (50% and 70%, respectively). The Pac-12 rarely incorporates a screening ECHO for all student-athletes or for men's basketball (0% and 29%, respectively). Finally, 82% of team physicians reported that they do not differentiate their screening protocol based on sex, race, or sport (Table 3).

Table 1. Conference response rates and representation

Conference	No. of Respondents/Possible Respondents (%)	Total Representation, ^a %
Atlantic Coast	9/15 (60)	20
Big 12	10/10 (100)	22
Big Ten	8/14 (57)	18
Pac-12	7/12 (58)	16
Southeastern	9/14 (64)	20
Did not identify conference affiliation	2	4

^aConference representation compared with the total number of participants in the sample.

Table 2. Cardiovascular screening protocols (N = 45)

	All Athletes, n (%)	Men's Basketball, n (%)
H&P only	17 (38)	10 ^a (22)
H&P + ECG	16 ^b (36)	15 (33)
H&P + ECG + ECHO	10 ^c (22)	17 ^d (38)
H&P + ECHO	2 (4)	3 (7)

ECG, electrocardiogram; ECHO, echocardiogram; H&P, history and physical.

^aOne school in this group also reported performing ECHO for athletes taller than 6 ft 10 in.

^bOne school in this group also reported performing a lipid profile.

^cOne school in this group also reported performing an examination by a cardiologist.

^dOne school in this group also reported including an examination by a cardiologist and a lipid profile.

Impact of Current SCD Epidemiology

Sixty-five percent of all team physicians reported using the overall risk of SCD in NCAA student-athletes when establishing their screening protocols, while 60% used the risk of SCD in men's basketball.

With regard to athletic conference, the conference with the greatest percentage of schools that took into consideration SCD-E evidence about all student-athlete risk as well as that specifically for men's basketball is the Pac-12 (100% in both cases). The conferences with the lowest percentage are the Big 12 for all student-athletes (50%) and Southeastern Conference for men's basketball (33%) (Table 4).

Team Physician Attitudes

Of the 15 team physicians who reported that they did not use the published SCD-E in establishing their screening protocols, 93% were "very unlikely" or "unlikely" to change their screening next year for all student-athletes based on SCD-E, while 1 reported being "very likely" to change. Among the 6 team physicians who reported only using preparticipation history and

Table 3. Differentiation of screening protocol based on sex, race, or sport (n = 44)^a

Response	n (%)
Sex	1 (2)
Race	0 (0)
Sport	7 (16)
Same protocol is used on all athletes	36 (82)

^aOne team physician did not respond to this question.

physical for all student athletes *and* not being aware of the SCD-E, 5 reported being "unlikely" or "very unlikely" to change their screening protocol. Among the 4 team physicians who reported only using preparticipation history and physical for men's basketball *and* not being aware of the SCD-E, 3 reported

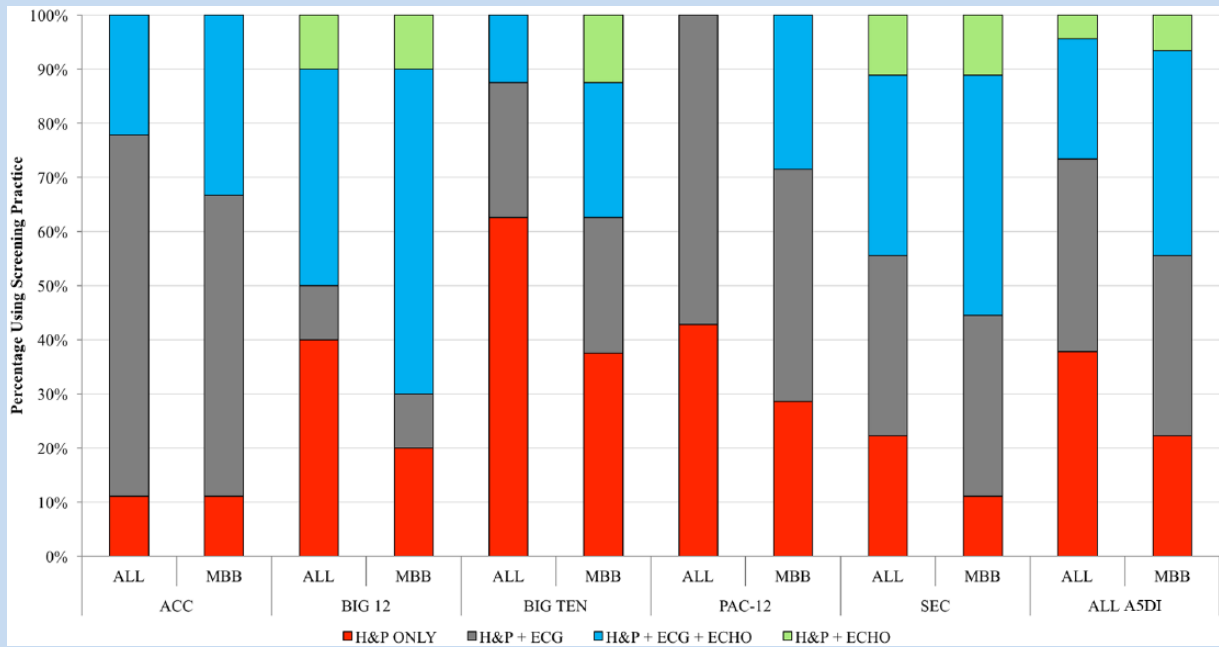


Figure 1. Cardiovascular screening protocol by conference. ACC, Atlantic Coast Conference; A5DI, Autonomous 5 Division I; ECG, electrocardiogram; ECHO, echocardiogram; H&P, history and physical; MBB, men’s basketball; SEC, Southeastern Conference.

Table 4. Consideration of sudden cardiac death epidemiologic evidence in developing a cardiovascular screening protocol (n = 43)^a

Response	ACC, n (%)	Big 12, n (%)	Big Ten, n (%)	Pac-12, n (%)	SEC, n (%)	Total, n (%)
All athletes	5 (56)	5 (50)	6 (75)	7 (100)	5 (56)	28 (65)
Men’s basketball	4 (44)	5 (50)	7 (88)	7 (100)	3 (33)	26 (60)

ACC, Atlantic Coast Conference; SEC, Southeastern Conference.
^aTwo team physicians did not respond to this question.

being “unlikely” or “very unlikely” to change their screening protocol based on awareness of SCD-E.

DISCUSSION

The current NCAA recommendations for cardiovascular screening of collegiate athletes includes at minimum a history and physical evaluation.¹² Importantly, both an interassociation guideline led by the NCAA and a position statement from the American Medical Society for Sports Medicine recognize that screening by history and physical alone has limited effectiveness for the identification of potentially lethal cardiac conditions and that screening questionnaires are not validated by scientific evidence.^{3,12} Both guidelines suggest that ECG can be considered in targeted risk groups when accurate ECG interpretation and adequate cardiology resources are available, and the NCAA has outlined best practices if ECG is used in the screening process.^{5,12}

When determining the merit of a screening tool, disease prevalence, event rates, test sensitivity/specificity, and cost are all

important factors. The NCAA SCD rates published in 2015 are notably higher than previous reports, presenting compelling evidence to reevaluate cardiovascular screening practices.^{13,14,17} In addition, the Seattle Criteria and subsequent revisions significantly improve the specificity and lower the false-positive rate for ECG screening.^{2,4,8,9,11,19,20,22} Indeed, ECG screening using modern interpretation standards has demonstrated a greater sensitivity and specificity than history and physical for the detection of cardiac conditions associated with SCD.^{4,6,7,10,15,20}

This study aimed to determine cardiovascular screening protocols within the A5DI conferences. Results demonstrate that most A5DI schools (62%) are performing NICS on all athletes, while 78% perform NICS on men’s basketball athletes. Thus, even though NICS is not required or mandated, most institutions within the A5DI responding to this survey already perform more intensive cardiac screening. This rate of NICS is higher than prior survey results of all Division I schools and considerably higher than lower-division schools (NCAA Division II and III, National Association of Intercollegiate Athletics, and junior

colleges).¹ As cost and local resources have been reported as a limitation to performing additional testing, it is likely that the additional resources of A5DI schools are at least partially if not largely responsible for the increase in NICS inclusion at A5DI schools. Other potential factors contributing to the difference in screening may include a deeper understanding of athlete SCD risk, more physician availability and cardiology resources at the A5DI schools, and perceived need to perform more involved testing in athletes at high-profile schools.

With the risk of SCD for Division I men's basketball players being almost 10-fold the risk for the general college student-athlete population, it would be reasonable to expect more involved cardiovascular screening in this group. A total of 71% of responding schools already include ECG in the cardiovascular screening of men's basketball athletes. While knowledge of SCD risk may have influenced this rate, most schools not performing ECG in high-risk groups indicated that SCD-E would not influence future protocol revisions. This suggests that other factors besides risk, such as resources, infrastructure, and team physician assessment of potential benefits and harms for ECG screening, may also affect the screening tools chosen.

Limitations

While a 69% response rate is favorable for a survey investigation, these results do not assess nearly one-third of the A5DI schools. Because participation was voluntary, there may be a selection bias in those schools that agreed to participate in the study toward schools that use NICS in their cardiovascular screening protocol. Moreover, the reliability of the questionnaire has not been validated. This study focused on cardiovascular screening practices based on SCD risk, and specific questions regarding other factors that could drive screening protocol decisions were not included. Other influences on screening protocols, such as revenue versus nonrevenue sports, physician training and cardiology resources, and physician beliefs about the potential benefits and harms of ECG screening, were not evaluated and could be addressed in future studies. In addition, investigation of current cardiovascular screening practices outside of the A5DI is needed.

CONCLUSION

While the inclusion of ECG and/or ECHO in the cardiovascular screening protocol of college athletes is still debated, NICS is currently used by the majority of A5DI schools responding to this survey. The majority of responding A5DI schools currently incorporate ECG in the cardiovascular screening for all student-athletes, and nearly three-quarters use ECG in the screening of men's basketball athletes. Team physicians not using NICS methods do not appear influenced by SCD-E, suggesting other factors may guide the screening protocol performed. Additional research is needed to understand and inform a more consistent standard for the cardiovascular screening of college athletes and targeted risk groups.

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