Preparticipation Cardiovascular Screening for US Collegiate Student-Athletes

Glen C. Pfister, BS
James C. Puffer, MD
Barry J. Maron, MD

The occurrence of unexpected sudden death in student-athletes due to unsuspected cardiovascular disease is an uncommon but often highly visible event that has heightened public concern and that of the medical community. Indeed, such catastrophes have stimulated considerable interest in the role of preparticipation screening. In this regard, we previously analyzed the status of screening in US high schools and judged that process to be deficient. Because the status of preparticipation cardiovascular screening available to student-athletes in college is unresolved, we believe it is timely to evaluate the strengths and limitations of this process.

Methods
We distributed survey questionnaires to the team physician or the athletic director or athletic trainer of the 1110 National Collegiate Athletic Association (NCAA) colleges and universities between 1995 and 1997. In these questionnaires, we solicited detailed information regarding the administration and scope of preparticipation screening, including credentials of team physicians and examiners, and the frequency and site of evaluations.

In a similar fashion, we contacted each institution by telephone to request the most recent version of the approved history and physical examination forms currently in use for preparticipation screening of varsity student-athletes. The content of these forms represents a guide to examiners and is the basis for screening at that institution. Those portions of the screening forms that were relevant to the cardiovascular system were analyzed and items pertaining to the history and physical examination were tabulated by one of us (G.C.P.) and compared with the 12 American Heart Association (AHA) 1996 consensus panel recommendations for preparticipation cardiovascular screening of athletes, which included the following: family history of (1) premature sudden death or (2) heart disease in surviving relatives; personal history of (3) heart murmur, (4) systemic hypertension, (5) excessive fatigue, (6) exertional syncope, (7) exertional chest pain, or (8) excessive exertional chest pain in student-athletes.

Context Sudden death in young competitive athletes due to unsuspected cardiovascular disease has heightened interest in preparticipation screening.

Objective To assess screening practices for detecting potentially lethal cardiovascular diseases in college-aged student-athletes.

Design, Setting, and Participants A total of 1110 National Collegiate Athletic Association member colleges and universities were surveyed between 1995 and 1997, with 879 (79%) responding to the questionnaire.

Main Outcome Measures Information on the administration and scope of the preparticipation screening process was obtained from the team physician or athletic director; preparticipation screening forms were evaluated for content and compared with 12 items recommended by the 1996 American Heart Association (AHA) consensus panel screening guidelines.

Results Preparticipation screening was a requirement at 855 (97%) of 879 schools, was performed on campus at 713 schools (81%), and was required annually by 446 schools (51%). Team physicians were responsible for examinations at 603 (85%) of 713 schools with on-campus screening, although 135 of these schools (19%) also approved nurse practitioners and 244 schools (34%) allowed athletic trainers to perform examinations. Of the history and physical examination screening forms analyzed from 625 institutions, only 163 schools (26%) had forms that contained at least 9 of the recommended 12 AHA screening guidelines and were judged to be adequate, whereas 150 (24%) contained 4 or fewer of these parameters and were considered to be inadequate. Smaller Division III schools were more likely than larger Division I schools to have inadequate screening forms (30% vs 14%: P<.001). Relevant items that were omitted from more than 40% of the screening forms included history of exertional chest pain, dyspnea, or fatigue; familial heart disease or premature sudden death; and physical stigmata or family history of Marfan syndrome.

Conclusion The preparticipation screening process used by many US colleges and universities may have limited potential to detect (or raise the suspicion of) cardiovascular abnormalities capable of causing sudden death in competitive student-athletes.
exertional shortness of breath; physical examination for (9) heart murmur, (10) femoral pulses, or (11) stigmata of Marfan syndrome; and (12) blood pressure measurement. Proportions were compared with the χ² test.

**RESULTS**

**Characteristics of the Screening Process**

Of the 1110 NCAA institutions initially surveyed, 879 (79%) returned the questionnaire including 286 Division I (schools with larger undergraduate enrollments that provide athletic scholarships), 256 Division II (institutions generally intermediate with respect to enrollment and scholarships), and 337 Division III (schools with the smallest enrollments that do not offer athletic scholarships.) A total of 855 (97%) of the 879 schools indicated that formal screening with a personal family history and physical examination was an absolute requirement prior to participation in varsity intercollegiate sports. Most institutions (713/879 [81%]) performed screening examinations in a college health care facility on campus, while the remainder (164/879 [19%]) occurred off-campus sites administered by nonuniversity health care personnel, with the athlete often having sole discretion for identifying the examining physician.

A designated team physician(s) was usually responsible for performing the evaluations at 603 (89%) of the 713 schools with screening on-campus, either alone or in association with nurse practitioners (n = 135) or athletic trainers (n = 244). Most of the team physicians specialized in orthopedic surgery (n = 451), while the others were most commonly in family practice (n = 348), internal medicine (n = 149), or pediatrics (n = 32). Physicians with formal cardiovascular training conducted examinations in only 33 of the institutions (5%).

Preparticipation screening evaluations were required each year by 446 (51%) of 879 schools, whereas 433 schools (49%) required a screening evaluation only on college entry. Only 58 schools (7%) routinely performed non-invasive testing (either 12-lead or exercise electrocardiograms, chest x-ray, or echocardiogram).

**Preparticipation Screening Forms**

The most recent versions of the screening history and physical examination forms were obtained from 625 institutions. Of these, 205 (33%) were from NCAA Division I schools, 176 (28%) were from Division II schools, and 244 (39%) were from Division III schools.

The content of the history and physical screening forms pertinent to the cardiovascular system are shown in the **Table**. Certain clinically relevant AHA-recommended items were included in only 9% to 52% of these forms: family history of Marfan syndrome, excessive fatigue, prior limitations placed on sports participation, excessive exertional shortness of breath, and exertional chest pain.

**COMMENT**

Sudden death due to cardiovascular disease in trained athletes is most common in high school and college-aged participants. High-intensity physical activity may act as a trigger to increase the risk of sudden death in predisposed athletes with underlying cardiovascular disease. These observations have raised awareness of pre-
PREPARTICIPATION CARDIOVASCULAR SCREENING FOR STUDENT-ATHLETES

Our observations should represent an impetus for change and improvement in the preparticipation cardiovascular screening process for college-aged athletes. We expect that improved screening would ultimately increase the potential for more frequent detection of certain cardiovascular lesions associated with sudden death in collegiate athletes.

REFERENCES