Controversies relating to preparticipation cardiovascular screening in young athletes: time for a realistic solution?

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The sudden death of any young individual is a tragic event that causes immeasurable damage to family lives. The sudden death of a young athlete from a cardiac disorder is particularly emotive and is often associated with considerable media coverage, drawing attention to the youth, the athletic prowess of the individual and the number of life years lost consequent to a cardiac disorder that could have been detected during life. Most exercise-related sudden cardiac deaths (SCDs) are attributed to congenital or hereditary cardiac disorders that are asymptomatic in most victims.1 2 Unsurprisingly, the death of a young athlete often galvanises urgent discussions relating to preparticipation cardiac screening involving members of the community, sports physicians and sporting governing bodies.

There is considerable resistance to implementing widespread cardiac screening of athletes. The low incidence of deaths and the low prevalence rates of all implicated disorders challenge the cost efficacy of such a programme. Furthermore, there are concerns relating to the overlap between the physiological adaptation to exercise and the cardiac disease resulting in false-positive results and unnecessary anxiety or even disqualification of an athlete from future competitive sport.3 It is also recognised that up to 11% of deaths in athletes occur at rest; therefore, cessation of sport will not necessarily prevent death in all athletes.1 Finally, there are issues relating to the lack of infrastructure and expert personnel trained in athlete’s heart and the broad phenotype of the heterogeneous disorders implicated in the sudden death of an athlete. The UK and many other Western countries do not favour screening of athletes. Indeed, screening of athletes in the UK is confined to elite sporting organisations such as the Premier League football association and the Lawn Tennis Association that mandate independently financed screening programmes in all youth athletes.

In the USA and Italy, preparticipation cardiac screening programmes are in existence to minimise the risk of sudden death due to cardiac disorders in young athletes.4 The US programme utilises a health questionnaire relating to cardiac symptoms and a family history of premature cardiac disease, as well as physical examination of the cardiovascular system. Unfortunately, the reputation of such basic screening programmes has been jeopardised by American physicians holding international expert status in sports cardiology studies that have emphatically demonstrated an extremely poor yield in identifying athletes with fatal disorders.5

In Italy, a state-sponsored screening programme has been in place since the late 1970s and includes a health questionnaire, a cardiovascular physical examination and a 12-lead electrocardiography (ECG). The Italian experience from Veneto has shown that screening with ECG has reduced the death rate in athletes from 4.19/100 000 person-years to 0.43/100 000 person-years, equating to a reduction of approximately 90%.6 The data have received immense publicity and are considered the criterion standard paradigm for low cost and effective cardiac screening in young athletes. The impact of the number of life years saved is laudable and would be considered a health service boost if similar number of life years were preserved in individuals in the fifth decade onwards. The reduction in these deaths was associated with a 7% of individuals requiring further investigations because of false-positive test results and the disqualification of 2% of all athletes screened predominantly because of hypertension, cardiac conduction disease and valvular heart disease. Most disqualifications are on anecdotal grounds and lack evidence-based credibility.

Unfortunately, there are no data from other European countries in the literature relating to screening young athletes that are comparable in magnitude with the Italian data, which can be simply explained by the fact that screening competitive athletes is not mandatory in most countries. Elston and Stein extrapolate findings from the Italian experience to apply directly to the UK in an attempt to facilitate the debate regarding the benefits, but more importantly, the potential harms of screening. Based on this fundamental assumption, the numerical implications of false-positive results and expected disqualifications from sport are discouraging. Of the potential 1 520 021 young athletes screened, 140 361 would require further investigations, and for every life saved, 791 athletes would be disqualified.4

However, the epidemiological study by Elston and Stein exhibits important limitations that may have influenced the results and underestimated the impact of screening in the prevention of SCDs in athletes and the population as a whole. The authors consider as post-screening period the first 25 years of screening (1982–2004), claiming that this may provide a more realistic picture, as it includes the period when screening mechanisms and expertise were developed and the full potential of screening is unlikely to have been realised. Consequently, the reported post-screening incidence of SCD is quoted as 1.57/100 000 person-years. This estimate is twofold higher than the reported incidence by Corrado et al of 0.87/100 000 person-years during the late screening period (1993–2004) and fourfold higher than the reported incidence of 0.43/100 000 person-years in the 2001–2004 period. Although a longer period may offer epidemiologically more robust results, it is important to acknowledge that the latter figure of 0.43/100 000 person-years is likely to provide a more accurate estimate of the real potential of screening that is reinforced by the fact that the incidence of SCD plateaus during the 2001–2004 period and is likely to have remained so during the proceeding years.

Furthermore, Elston and Stein underestimate the incidence of SCD in young (14–35 years old) individuals in the UK. A recent study analysing the Office of National Statistics data indicates around 400 SCDs per year in the UK in this age group, which is likely to be

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Br J Sports Med March 2011 Vol 45 No 3 165
Editorial

an underestimate of the true incidence
given the experience from previous pro-
spective epidemiological studies within
the UK and potential misclassifications
of SCDs as epilepsy or accidental
The study also fails to take into account
current screening experience in the UK.8
Our own experience of screening highly
trained athletes using the Italian model
indicates a lower false-positive rate of
3.7%, compared with 9% by Corrado
et al. This is most likely to reflect the dif-
fferences in interpretation of an abnormal
ECG because in our practice, isolated
large QRS complexes, borderline right
axis deviation, a borderline prolonged
QTc9 and T-wave inversions in the right
precordial leads in athletes <16 years
old10 would not be indications for fur-
ther investigations in asymptomatic ath-
letes in the absence of a family history
of premature cardiac disease or SCD.
Similarly, there is no evidence that ath-
letes with hypertension who continue to
exercise are at risk of a mortality, and
the insignificance of mitral valve prolapse and
isolated ventricular extrasystoles in the
aetiology of sudden death is debatable.
Therefore, such athletes should not be
considered to be at risk of sudden death
and would not be advised to refrain from
exercise. Conversely, the UK is more eth-
ically diverse than the Veneto region of
Italy. In particular, there are significantly
more athletes of Afro-Caribbean origin in
the UK who are known to exhibit bizarre
repolarisation electrical changes and may
generate a significant number of false-
positive results.

In a prospective and ongoing pilot study
involving >8000 athletes conducted by the
charitable organisation Cardiac Risk in the
Young (CRY), a potentially fatal disorder
is identified in 0.3%. This figure is not
dissimilar to the Italian data. However, the
false-positive rate in this study is
<4% (unpublished data). Should one
consider treatable conditions such as the
Wolff–Parkinson–White syndrome and
right ventricular outflow tract ventricular
tachycardia, then the permanent disquali-
ﬁcation rates and the number of athletes
disqualified for every life saved would be
reduced dramatically. Although the precise
false-negative rate is unknown, a mean
8-year follow-up had identified only one
athlete with an SCD from an anomalous
coronary artery disease, a disorder that
cannot be identified with 12-lead ECG.

Such prospective screening programmes
are crucial to solving the debate and pro-
viding the British perspective relating to
the cardiac screening of asymptomatic
young athletes.

Finally, Elston and Stein places par-
ticular emphasis on minor harms such as
elevated anxiety caused by false-positive
results. Studies from established screen-
ing programmes indicate that individuals
with a false-positive result may experience
considerable anxiety until further
investigations provide reassurance, which
highlight the need for prompt evaluation
of athletes who fail the initial screening.
However, an apprehensive approach over
long-term psychological scarring of ath-
letes with an initial false-positive result
requiring further detailed investigations
is not justified because evidence from the
same studies indicate that in the context
of a well-organised screening programme
with expert psychological support, there
is no signiﬁcant long-term psychological
burden.5

The ﬁnancial constraints within the
National Health Service; the priority in
apportioning the budgets in reduc-
ing deaths from myocardial infarction,
stroke and neoplastic disorders; the
lack of expertise and the lack of robust
cost-effectiveness studies means that a
nationwide screening of all young
individuals participating in competitive
sports cannot be currently implemented.
Benevolent pragmatists advocate rais-
ing the awareness of the risk of SCD
in sport and screening only those with
a family history of hereditary cardiac
disorders or symptomatic manifestation
of cardiac disease. Such a strategy, how-
ever, will deny most athletes from being
screened and fail to identify up to 80%
of athletes at risk of sudden death. These
limitations should prompt the develop-
ment of a collaborative scheme between
the government, charity organisations
such as CRY and sporting bodies to pro-
vide an initiative to offer cost-effective
screening with 12-lead ECG for athletes
who choose to be screened for their self-protection.

Funding SS, MP and NC work in the National Health
Service. MP and NC are funded by a research grant from
the charitable organisation Cardiac Risk in the Young (CRY),
which supports preparticipation screening in young athletes.

Competing interests The charitable organisation
Cardiac Risk in the Young (CRY), which supports pre-
participation screening in young athletes, has provided
facilities, including necessary staffing, electrocardiogra-
phy and echocardiography machines for screening many
national sporting squads including rugby, tennis, boxing,
swimming, athletics and football. The data from the
screening programme have resulted in several publica-
tions in major peer-reviewed journals. SS is a consultant
cardiologist to CRY.

Patient consent Not obtained.

Contributors MP, NC and SS drafted the article and
revised it critically for scientiﬁc content and approved
the ﬁnal version for publication. SS is the guarantor.

Provenance and peer review Not commissioned;
not externally peer reviewed.

Accepted 18 September 2009
Published Online First 21 October 2009
doi:10.1136/bjsm.2009.067652

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Br J Sports Med 2011 45: 165-166 originally published online October 21, 2009
doi: 10.1136/bjsm.2009.067652

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