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ORIGINAL STUDY

THE EFFECTS OF PHYSICAL TRAINING OVER QT DISPERSION AND QTc DISPERSION TO THE BEGINNER SPORTSMEN

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ABSTRACT

Objective: to demonstrate the impact of performance physical training (dynamic and static) over QT interval, QT and QTc dispersion. The study lasted for six months and studied 13-14 years old childrens, beginners in performance sport. They were grouped into two lots of 30 childrens: one lot dynamic physical effort athletes; the other static physical effort athletes.The QT interval was measured during three consecutive cycles.Qt and QTc dispersion was calculated as the difference between the longest and shortest QT length on twelve-lead ECG.QTc was calculated by using Bazzet's formula.This work aim at investigating the connection between performance physical effort and QT interval in order to: 1) verify whether the performance physical training causes a prolongation of QT and QTc dispersion; 2) determine the difference between dynamic and static physical effort; 3) evaluate the necessity of DQT and DQTc screening as risk indicator for ventricular arrhythmias at professional athletes..

The present study is one of the few which had investigated all those parameters at the referred age.

KEYWORDS*: QT dispersion (DQT); QTc dispersion (DQTc); children; athlete; risk; ventricular arrhythmias.*

1. Introduction

QT and QTc dispersion is a concept that is specified in medical literature for two decades and is considered to be an indirect method in heterogenity ventricular repolarization appreciation [1]. The prolongation of QT interval, due a variety of causes, was associated with an increased risk of ventricular arrhythmias and sudden death. The subject has generated a lot of contradictions and numerous studies were made during the last 2 decades, but it was not established a proper interval of normal values according to age and sex. Thus, Savalieva et al. [2] had founded DQT values of 29±18 ms in the age interval 17-29, 26±16 ms in the age interval 30-49 si 24±13 ms in the age interval 50-80. In the study were included 1096 healthy subjects. Another major study by Mac Farlane et al. [3] is not demonstrating significant differences for variated ages: DQT = 28±8 ms under 30 y.o., 25±8 ms at 30-40 y.o., 24±10 ms over 40 y.o.

With regard of sex influence over DQT were noticed increased valueas at men towards women but these differences are not statistically significant.These differences have increased and became statistically significant at ages over 50 y.o.[2] Likewise, there are statistically significant differences of DQT between premenopause healthy women (average 30 ms) and postmenopause healthy women (average 54 ms) due to progesterone deficiency(4).

We have to point that DQT and DQTc studies are extremely rares under the age of 15 and the correlations with performance physical effort are also very rare. Physical effort is solicitating the energetical systems, cardiovascular system, respiratory and muscular system and also the psychic system and is forcing the body to accommodate and having as a result an increased effort and performance capacity. The cardiovascular system will react different for every type of effort. The cardiovascular adaptation to the effort is an expression of normal evolution and it's conditioned by individual differences between answering reactions determined by effort. We have to point that there are differences between the reactions caused by dynamic effort and the reactions caused by static training as a consequence physiological,biochemical and biomechanical particularities of the twotypes of effort. The cardiovascular adaptation to physical effort consists of morphological myocardial modifications and functional myocardial adaptations with repercursions over ventricular repolarisation and over QT interval and QT dispersion.

We haven't found in romanian specialized literature any study regarding DQT and the effects of professional training over this parameter by beginners athletes. This study stands at the crossing of 3 medical specialties cardiology, pediatry, sport medicine and want to demonstrate the changing of DQT as a consequence of athlete's hearth.

2. Material and methods

The time of study was between 1.01.2009 and 1.08.2009. We have monitored 60 athletes, age 13 – 14 y.o., separated in 2 groups: group 1 wich includes 30 athletes involved in dynamic training (football, athletism) and group 2 wich includes 30 athletes involved in static effort (weight liters, wrestlers).The athletes are legitimated in sport clubs in Galati and were included in the study in virtue of obligatory biannual medical check at the Sport Medicine Praxis Galati.

Participation criterion:

- Childrens age 13 – 14, beginners as performance athlete
- Children without any other anterior performance sport activities
- Continuity in training during 6 months
- 2 medical exams in a row

Exclusion criterion:

- Childrens with anterior performance training
- Childrens without 2 medical exams in a row in the specified period.

We performed clinical exams at the beginning,during and at the finish of the period and a rigorous anamnesis of the childrens and theirs families fordetecting any sign of cardiac arrhythmia during physical effort or in repose. We have recorded 12-lead ECGs speed 25 mm/s, with a BTL-07 win electrocardiograph.We've measured the heart rate, the pace, the electrical axis, the QT length (automatically and with the slide rule during 3 consecutive cycles). DQT was calculated as the difference between the longest and the shortes QT interval.QTc and DQTc were calculated by using Bazzet formula.

There are variations of these values but the references values were established by preceding cardiological and pediatrical studies. We have refered at an average value ≤ 40 ms with a peak 55-60 ms for DQT; and a maximal 60 ms for DQTc.

We have further compared the obtained values with the values from a previous study made on performance athletes, ages 14-17 (the same method was used).in the previous study the values of DQT were 43,53±21,03 ms (dynamic effort) and 48,23±12,56 ms (static effort) and DQTc 50,81±19,34 ms and 53,59±17,21 ms (5).

Sinus arrhythmia was not changing the values of DQT but has made problems in DQTc calculation.

3. Results

During the study any of the participants has experienced major cardiac arrhythmias.

The interpretation were made according to heart rate, type of physical effort and sinus arrhythmia that was recorded at 17 from 60 tested athletes.It couldn't be done an analyse according to sex due the fact that only 9 girls were included.

We haven't recorded significant differences of the parameters between the 2 groups neither in the initial moment nore after 6 months training. Though we can mention a slight increasing of QT interval and DQTc. DQT is very slight increasing at the performers involved in dynamic effort and a little bitt accentuaded at the performers involved in static effort (table I,II).

4. Discussions

The prolongation of QT interval by different mechanisms and the increasing of DQT have been associated with a significant increasing risk of cardiac arrhythmias at bowth adults and childrens.regarding the addiction of QT interval values by heart rate and regarding the possibility of QTc calculation, we have a better forecast of arrhythmia risk.The easy way to calculate QTc permits a currency using specialy by childrens and teenagers.

Table I. *Heart rate, Qt, QTc, DQT, DQTc (to start training sports performance characteristic) January 2009*

	Group I (effort of endurance exercise)	**Group II (effort odf static group)**	**Group I + group II**
Heart rate (b/min)	80	83	81,5
QT med(ms)	319	320,2	319,6
QTc med (ms)	368	376,1	372,05
DQT med (ms)	29,4	29,6	29,5
DQTc med (ms)	47,1	46,9	47

Table II. *Heart rate, Qt, QTc, DQT, DQTc (after 6 months of training sport specific performance) July 2009*

	Group I (effort of endurance exercise)	**Group II (effort odf static group)**	**Group I + group II**
Heart rate (b/min)	74	74	74
QT med(ms)	321,2	322,1	321,65
QTc med (ms)	356,4	358,3	357,35
DQT med (ms)	30,2	31	30,6
DQTc med (ms)	48,3	48,9	48,6

Previous studies of the QT interval and dispersion were made frequently in adult population.Macfarlane et al. [6], in a study that includes 1555 adults, established the higher limit of DQT at 40 ms.Other studies that included adults, considered as normal a value of 30 – 50ms of DQT and 40 – 60 ms for DQTc.

Studies that included persons under the age of 18 were very rare and didn't show a standard for QT and DQT. We can mention the study of H.Ercan

Tutaret et al. [7] that includes 372 healthy childrens with an average of DQT = 29,9 ms and DQTc = 47,3 ms.

In a previous study that we have presented at the Annual AEPC Meeting in Warsaw 2007 (5) we have determined, on a 20 childrens and teenagers group, normal limit values DQT = 35,88±10,22 ms and DQTc = 39,23±14,81 ms. In the mentioned study we haven't determined the period of performance training by athletes , but we have established the followings aspects : the average values of DQT and DQTc were higher to athletes in compare with non-athletes but the differences were not significant (group I :QTD=43,54±21,03 ms DQTc=50,81±19,34 ms, group II : DQT=48,23±12,56 ms DQTc=53,59±17,21 ms, martor : DQT=35,88±10,22 ms DQTc=39,23±14,81 ms). (table 1,2) The highest values were measured by the athletes involved in static effort, fact that can be associated with a higher cardiac arrhythmia risc.It is also important to nottice that we haven't found any case with a QT value over normal.

The present study evaluate the DQT interval and DQTc not only according to intensity and type of effort but also according to the exact period of performance training. So can we to observe if the modifications occur relatively early or after a longer period of time. That means that we can conclude if the cardiac arrhythmia risk is a presence not only at performance athletes but also at beginners.

The differences between the average values of QT and QTc interval at the beggining of the training were statistically insignificant compared to the values of the same parameters by the martor group in the previous study.

At the beginning of the performance training the values were very close in the 2 groups. After 6 months effort, DQT has increased with an average value of 0,8ms in the group I and with 1,4 ms in the group II. Regarding at DQTc we have noticed an average increasing by 1,2 ms in the group I and 3 ms in the group II. Comparing the results we can say that after 6 months of training we have higher values by 0,8 ms for DQT and 0,6 ms for DQTc in group II.

We haven't done a statistical evaluation according the age while the childrens were approximately the same age.

Although the values in the study are in normal limits, the physical effort have an effect over the QT parameters, after just 6 months of training due to athlete's heart development.

The most important increasing was found in group II and we can explain that by the type of effort and its cardiovascular consequence. We describe the dynamic effort as a cardiac work against a volumetric resistance with an adaptative cardiac dilatation while the static effort is a cardiac work against a pressure resistance with an adaptative cardiac answer as concentric hypertrophy.

The modifications of DQT and DQTc at teenager athlete with a significance for arrhythmic risk justifies the calculation of those parameters at the medical exams. Just a simple ECG, most of the time normal, cannt assess the cardiac risk.

5. Conclusions

The physical effort in performance training has as a consequence the increasing of DQT and DQTc due to athletic heart.

The static effort involves higher DQT and DQTc as the dynamic effort.

Demonstrating the increasing values of DQT and DQTc right after a few months of systematic training recommend the screening utility as a ventricular arrhythmia risk indicator by performance athletes.

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