Cystic Fibrosis Research News

Title:

Feasibility and normal values of an integrated conductivity (Nanoduct™) sweat test system in healthy newborns

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What was your research question?

We tested the usefulness of the Nanoduct™ sweat test in newborns aged four days and again at four weeks. This test looks at the capacity of sweat to conduct electrical current, which is affected by chloride levels. This means we can estimate the amount of chloride in a sweat sample from the conductivity test.

In particular, we wanted to know the proportion of newborns in whom the test gives technically valid results, how long it takes and what the results for sweat conductivity are in healthy infants of the same age.

Why is this important?

The sweat test, which measures the concentration of chloride (salt) in sweat, is key in diagnosising cystic fibrosis (CF) in infants with a positive result in newborn screening (NBS). Collecting sufficient sweat for the test is a challenge in small infants, and tests fail in up to 40% of newborns. The widely used Macroduct™ collection system needs 15 microlitres of sweat to analyze chloride levels, while the sweat flow sensor of the Nanoduct™ system requires only 3 microlitres. This makes it especially easy to use in newborns. However, little research has been done on the Nanoduct™ and we don't know in which proportion of children its possible to obtain valid results, and what the values are for healthy newborns.

What did you do?

We used the Nanoduct™ sweat test to measure sweat conductivity in 260 healthy infants born at term. We took measurements when the infants were four days old and again when they were four weeks old. At both time points, we measured the proportion of successful tests and the duration of the tests. We recorded the results on conductivity that we obtained from these healthy infants, to establish 'so called' normal values for these age groups.

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What did you find?

At age four days, 61% of infants produced enough sweat to allow a successful measurement of conductivity with the Nanoduct™, while 9% produced too little sweat and 30% did not sweat at all. When they were four weeks old, 94% of the infants produced sufficient sweat. In the four-week old infants conductivity values were comparable to values measured in older children, and had a symmetrical (normal) statistical distribution. These values ranged from 12-64 mmol/L , with an average (mean) of 35 mmol/L . The upper limit of normal (below which 97.5% of all results from healthy children fall) was 53 mmol/L, and only 2% of children had values above 60 mmol/L.

What does this mean and reasons for caution?

This study is the first to provide normal ranges for sweat conductivity using the Nanoduct™ sweat test system for healthy newborns. We found that Nanoduct™ cannot be recommended for four-day old newborns. However, at the age of four weeks the success rate is high (94%), and conductivity values at that age are comparable to those reported for older healthy children. This suggests that Nanoduct™ might be a suitable sweat test for NBS programs in which children are seen in the first months of life.

What's next?

We will compare the usefulness of conductivity measurements using Nanoduct™ with chloride measurements obtained by Macroduct™ in the current Swiss NBS programme for CF, which includes both infants with and without CF.

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