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Early hearing screening: What is the best strategy?

Catherine Kolski*, Barbara Le Driant, Philippe Lorenzo, Luc Vandromme, Vladimir Strunski

University Hospital of Picardy, Department of Otorhinlaryngology, Place Victor Pauchet, 80000 Amiens, France

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Summary

Objectives: A discussion concerning the relevance of universal newborn hearing screening has been conducted in France since the end of the 1990s. As a contribution to the choice of strategy to be implemented, we evaluated and compared the results of this screening and its impact on the parent—infant relationship as a function of the time at which screening was performed: during the infant's stay in the maternity unit, in the first strategy (strategy 1), or 2 months after birth, in the second strategy (strategy 2).
Patients and method: Five thousand seven hundred and ninety infants participated in the study: 3202 were included in the first strategy and 2588 were included in the second strategy. Within this population, 143 mother—infant pairs were submitted to psychological assessment. We compared the number of infants screened, the number of first positive tests, the number of false-positive tests and the number of infants not reviewed after screening. Adverse effects on the parent—infant relationship were evaluated in terms of maternal anxiety and the quality of early interactions.
Results: A statistically significant difference in favor of newborn screening was demonstrated for the number of infants screened: 95.72% for the first strategy [95.0%; 96.4%], 64.18% for the second strategy [62.3%; 66.0%]; the number of first positive tests: 1.11% during newborn screening [0.7%; 1.5%], 3.13% in the second strategy [2.3%; 4.0%]; the number of false-positive tests: 0.29% in the first strategy [0.10%; 0.49%] and 2.65% in the second strategy [1.88%; 3.42%]; and the number of infants not reviewed after screening: 8.8% during newborn screening [0.0%; 18.4%] and 38.5% in the second strategy [25.2%; 51.7%]. Analysis of the results of the psychological assessment showed that screening *per se* did not have any impact on maternal anxiety or on the quality of early interactions, regardless of the screening strategy used. However, the result of the test had a significant impact. Announcement of a positive result increased maternal anxiety and induced a deterioration of the mother's psychological state which affected the quality of early interactions. As the

* Corresponding author. Tel.: +33 322668333; fax: +33 322668623.
E-mail address: kolski.catherine@chu-amiens.fr (C. Kolski).

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number of positive results is significantly lower in newborn hearing screening, there are consequently fewer psychological side effects with this strategy than with the second strategy.
Conclusion: This study demonstrates that universal newborn hearing screening is the most efficient strategy.

1. Introduction

Permanent newborn deafness is a serious and frequent disability [1] and induces a series of developmental disorders affecting communication, language and cognitive development [2] which can be prevented or attenuated by early diagnosis and management [3—5]. Despite these arguments in favor of very early hearing screening, some professionals have expressed reservations concerning the real benefit of newborn screening because of the low positive predictive value of the screening test which often leads to announcing a false-positive result and because of the poorly elucidated consequences of this announcement on the parent—infant relationship [6,7]. Universal hearing screening has not yet been organized throughout France, but a discussion of the relevance of this screening has been underway since the end of the 1990s. The objective of this study was to assist in the choice of screening strategy by evaluating and comparing the results of universal hearing screening and its adverse effects on the parent—infant relationship according to the time at which screening is performed: during the neonatal period in the maternity unit (strategy 1) or 2 months after birth (strategy 2).

2. Method

(1) *The study population* consisted of 5790 healthy infants: 3202 were included in the first screening strategy and 2588 were included in the second screening strategy. Within this population, 143 mother—infant pairs were submitted to psychological assessment. Only mother—infant pairs comprising infants born after a normal pregnancy, by vaginal delivery, with no risk factors for deafness, not hospitalized and with negative tests for the other diseases screened during the neonatal period were included in this assessment. One hundred and fifteen infants were screened: 58 according to the first strategy and 57 according to the second strategy. Twenty-eight mother—infant pairs without screening constituted the control group for each of the strategies.

(2) *The duration of inclusion* was 6 months for each of the strategies. The same strategy was applied at the same time in all maternity units and screening was performed during the same period for two consecutive years (from 15 September to 15 March) to minimize the bias of the frequency of middle ear dysfunction, which is more frequent during certain seasons, on the results of the test [8,9].

(3) *Screening endpoints* were: number of infants screened, number of infants with a positive test at the first step of screening and requiring a second step, number of false-positive results and number of infants not reviewed after screening. The adverse effects on the parent—infant relationship were evaluated in terms of maternal anxiety and the quality of early interactions.

(4) *Tools*. The screening test consists of recording otoacoustic emissions with retesting some weeks later when the first test was positive. The same automated recording apparatus (Echocheck-Otodynamics) was used at all screening sites. Maternal anxiety and the quality of early interactions were evaluated by a psychologist during two semi-directive interviews comprising scoring of several scales that had been validated in a previous study:
- MADRS scale [10] that investigates several dimensions of post-partum depression,
- the anxiety scale comprising certain items of the EPDS questionnaire [11] (Edinburgh postnatal depression scale) and certain items of the Kennerley self-administered questionnaire [12].
- The interaction scale, which investigates visual, physical, mental and social dimensions of the mother—infant relationship.

(5) *Protocol*. In both strategies, parents received oral and written information about the screening program and the proposed study on their arrival in the maternity unit and their consent to participate in the study was obtained.
- *Strategy 1*: neonatal screening in the maternity unit. Screening was performed on D3 in the maternity unit.
- *Strategy 2*: screening at 2 months. The parents left the maternity unit with an