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Review

Epidemiological prenatal ultrasound studies

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Abstract

Epidemiological studies have indicated no association between diagnostic ultrasound exposure during pregnancy and childhood malignancies. Diagnostic ultrasound imaging does not seem to influence birth weight, whereas frequent Doppler ultrasound was associated with reduced birth weight in one study. Most experts do not believe that ultrasound exposure during pregnancy is associated with reduced birth weight. There are no confirmed statistically significant associations between ultrasound and dyslexia and neurological development during childhood. However, two randomised controlled trials and two cohort studies have been unable to rule out a possible association between ultrasound and left-handedness among males.

Keywords: Prenatal ultrasound; Childhood malignancies; Birth weight; Handedness; Dyslexia

Contents

1. Introduction

It is necessary to study directly the effect of prenatal ultrasound in human populations before any definitive statements regarding risk can be made. With an increasing number of epidemiological studies of diagnostic ultrasound, the need to review and interpret the results from these studies is evident. However, the acoustic outputs from modern devices have increased 10–15 fold during the last decades (Duck and Martin, 1991; Henderson et al., 1997), and the epidemiologic evidence derives from scanners in commercial use 15–20 years

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Table 1
Observational studies of human exposure to diagnostic ultrasound during pregnancy

Type of study	Name of first author	Outcomes assessed	Number of individuals	Year of publication	Year of US exposure
Longitudinal	Scheidt	123 variables, 0–1 year (neurology, hearing, birth weight)	1907	1978	<1976
Case-control	Wilson	Childhood cancer	3462	1984	<1981
	Cartwright	Childhood cancer	1665	1984	<1983
	Sorahan	Childhood cancer	1040	1994	<1991
	Shu	Childhood cancer	1284	1995	<1984
	Naumberg	Childhood cancer	1203	2000	<1985
Cohort	Stark	17 variables, age 7–12 years (dyslexia, neurology, hearing)	806	1984	1968–1972
	Moore	Birth weight	2129	1988	1981
	Lyons	Growth, 0–6 years	298	1988	1975–1980
	Kieler	Left-handedness, men 19 years	180,000	2001	1973–1978
	Kieler	Left-handedness, men 19 years	27,200	2002	1978
	Kieler	IQ scores, men 19 years	206,000	2005	1973–1978

Table 2
Randomised controlled trials (RCTs) of human exposure to diagnostic ultrasound during pregnancy

Type of study	Name of first author	Outcomes assessed	Number of individuals	Year of publication	Year of US exposure
RCTs B-mode	Bakketeig	Birth weight	1017	1984	1979–1981
	Eik-Nes	Birth weight	1628	1984	1979–1981
	Waldenstrøm	Birth weight	4997	1988	1985–1987
	Saari-Kempainen	Birth weight	9310	1990	1986–1987
	Salvesen	6 hypotheses, age 8–9 years (dyslexia, handedness, growth, neurology, hearing, vision)	2161	1992–1994	1979–1981
	Kieler	5 hypotheses, age 8–9 years (left-handedness, growth, neurology, hearing, vision)	3265	1997–1998	1985–1987
RCTs Doppler	Newnham	Birth weight	2834	1993	1989–1991
	Newnham	Childhood development (growth, neurology, language)	2834	2004	1989–1991
	Davies	Birth weight	2154	1992	1989

ago. If adverse effects of ultrasound during pregnancy are dose dependent, one must acknowledge that the available epidemiological data are limited. The fact that there are no epidemiological data from modern devices, implies that ultrasound should be used prudently, keeping the output levels as low as reasonable achievable (the ALARA principle).

This paper will discuss the epidemiological evidence from studies on prenatal ultrasound and subsequent childhood development with emphasis on childhood malignancies, birth weight, neurological development, dyslexia and handedness. The epidemiological studies are presented in Tables 1 and 2. There is a hierarchy of studies based on study design and the quality of the research methods. Highest value should be given to randomised controlled trials, and less value to cohort studies, case-control studies and other observational studies (in that order). There are no epidemiological prenatal ultrasound studies with commercially available ultrasound devices produced after 1990.