



Dermatoglyphics and Schizophrenia: A meta-analysis and investigation of the impact of obstetric complications upon a–b ridge count

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Abstract

Background: Patients with schizophrenia show deviances in their dermatoglyphics, in particular reductions in palmar a–b ridge counts (ABRCs), which are evidence of an early developmental deviance. However, the severity or the origin of these ABRC changes has not been established.

Method: (i) We examined the published literature on the ABRC in patients with schizophrenia against controls with a random effects meta-analysis. (ii) We used linear regression to study the ABRC in our sample of families including 125 patients with schizophrenia, 107 of their unaffected relatives and 98 controls. (iii) The effect of obstetric complications on the patient's ABRC was examined using the Lewis Murray scale.

Results: The pooled standardised effect size of ABRC differences between patients and controls obtained by our meta-analysis was 0.39 (95% CI: 0.05–0.73; $p=0.03$). In our sample, there were no significant differences in ABRCs between those with schizophrenia, their relatives and controls. Only those patients with obstetric complications had significantly reduced ABRC compared to controls ($p=0.01$).

Conclusions: We confirmed the presence of significant yet mild ABRC reductions in schizophrenia. These represent a subtle deviance from the norm and could be present in certain subsets of patients, possibly those who suffered early developmental insults.

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Keywords: Dermatoglyphics; a–b Ridge count; Obstetric complications; Family study; Schizophrenia; Meta-analysis

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1. Introduction

Epidermal ridges, also known as dermatoglyphics, appear on the hand between weeks 6 and 15 of life, and after this period, they remain unchanged (Davis and Bracha, 1996). Patients with schizophrenia display an increased prevalence of apparently innocent changes in the patterns and counts of their dermatoglyphics (Fañanás et al., 1990; Bracha et al., 1991; Saha et al., 2003). In particular, a number of studies, summarised in Table 1, show that the a–b ridge count (ABRC), a quantitative dermatoglyphic measure of the palm, is reduced in patients with schizophrenia. However, several studies have not found such a–b ridge count reductions (Table 1) and the severity or the origin of such deviances has not been established.

Dermatoglyphic alterations in schizophrenia are markers of disrupted early development and contribute support to the neurodevelopmental model of schizophrenia (Murray and Lewis, 1987; Bramon and Murray, 2001). They show that an insult, whether genetic, environmental or both, occurred during early–mid gestation (Green et al., 1994; Rosa et al., 2002).

We set out to perform a meta-analysis of the published literature on ABRC in schizophrenia. We also examined the ABRC in our sample of families with members affected with schizophrenia.

2. Methods and materials

2.1. Meta-analysis

A meta-analysis of peer-reviewed articles comparing the a–b ridge count in patients with schizophrenia against controls was conducted in both Medline and in Science Citation Index from January 1983 to December 2003. For each primary study, the standardised effect size of the ABRC was defined as the difference between control and patient group means divided by the pooled standard deviation. The standardised effect sizes were subsequently analysed using random effects meta-analysis, which provides a pooled effect size after weighting the effect size of each primary study by the inverse of its variance. A test of heterogeneity between study results was also carried out. We tested for publication bias using Begg and Mazumdar's (1994) adjusted rank correlation test. Further details on meta-analysis methods used can be found in Bramon et al. (2004a,b).

2.2. Local study

This included 125 probands, 107 of their unaffected first-degree relatives and 98 unrelated controls with no personal or family history of psychosis. Further details on the nature of the sample have been described previously (McDonald et al., 2002; Bramon

Table 1
The a–b ridge count in schizophrenia: studies published from 1983 to 2003

Study	Sample size (P/C)	Population	Patients mean (S.D.)	Controls mean (S.D.)	ES	P-value
Fañanás et al., 1990	125/72	Spanish	76.60 (9.78)	81.53 (9.81)	0.50	*
Turek, 1990	310/400	Croatian	71.34 (9.88)	84.14 (12.03)	1.15	***
Fañanás et al., 1996	92/69 (sample a)	British	76.20 (11.10)	81.40 (11.40)	0.46	*
	339/59 (sample b)	British	79.20 (9.40)	83.00 (5.10)	0.43	*
Cantor-Graae et al., 1998	60/75	Swedish	79.94 (9.37)	80.24 (9.48)	0.03	n.s.
Fearon et al., 2001	150/92	Irish	78.00 (16.1)	82.60 (14.70)	0.29	*
Reilly et al., 2001	27/37	Irish	79.19 (14.94)	84.17 (11.22)	0.39	n.s.
van Oel et al., 2001	19/70	Dutch	78.41 (12.19)	80.73 (10.53)	0.21	*
Saha et al., 2003	181/228	Australian	84.31 (9.88)	83.83 (10.89)	−0.05	n.s.

Published studies included in the meta-analysis of the ABRC comparing patients with schizophrenia and controls. ES: effect size, calculated as (mean for controls–mean for patients)/pooled standard deviation. The P-values of the original studies were either n.s.=non significant, *=significant at the 5% level or ***=significant at the 1% level.

et al., 2004a,b). All participants were of Caucasian ethnicity and underwent a detailed clinical assessment to obtain DSM 4 diagnoses. They all gave written informed consent to enter the study. This research was approved by the Institute of Psychiatry Ethical Committee.

Obstetric data was gathered via maternal interview using the Lewis–Murray scale (Lewis et al., 1989). Mothers were available and willing to participate for 96 patients only. Those patients were classified in two subgroups having either ‘definite’ complications or alternatively having none or ‘equivocal’ complications.

2.3. Dermatoglyphic analysis

The a–b ridge count is a quantitative dermatoglyphic metric of the second inter-digital area of the palm. BM and LF, who were blind to diagnosis and obstetric complication data, measured the a–b ridge counts according to Cummins and Midlo (1961). Further details are described in Fig. 1.

2.4. Statistical analyses

Comparisons of the total a–b ridge count across the three groups were conducted using linear regression with robust standard errors, accounting for any correlations within families. Only where the effect of group was significant were post hoc comparisons and multiple testing adjustments conducted. Finally, a subsidiary linear regression analysis was conducted to examine the impact of obstetric complications on ABRC with two planned comparisons: (i) Patients with equivocal or no obstetric complications against controls. (ii) Patients with definite obstetric complications against controls. All analyses were carried out using STATA 7.0 (STATA, College Station, TX, USA).

3. Results

3.1. Meta-analysis of the previous literature

We identified nine studies suitable for analysis, which are summarised in Table 1, and included 1303

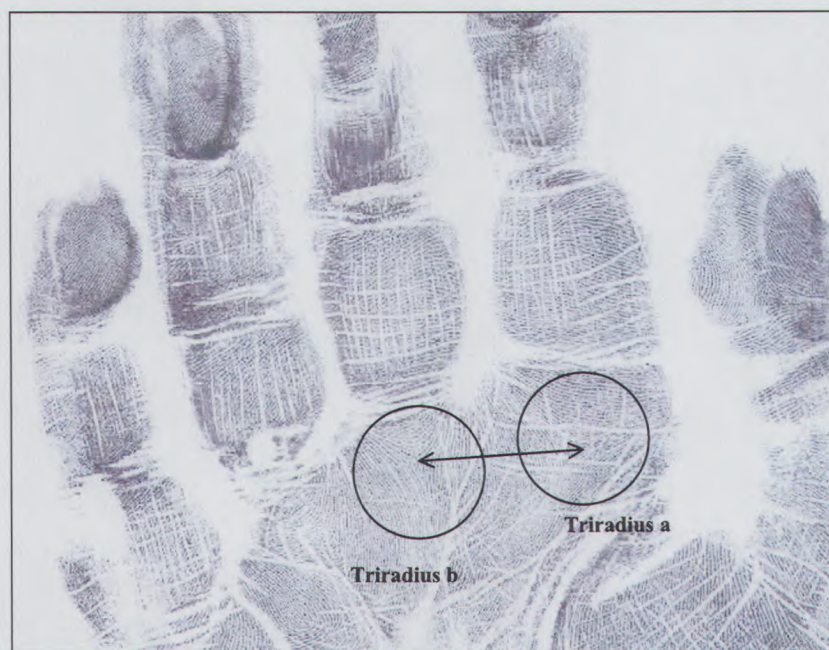


Fig. 1. The a–b ridge count. Whenever three ridge systems meet at a point this is known as triradius. There are usually four triradii in each palm, placed at the base of digits 2 through 5. The triradii at the base of the index and middle fingers are known as A and B, respectively. The a–b ridge count (ABRC) is the number of ridges between triradii A and B for both left and right hand added together (Cummins and Midlo, 1961).

patients and 1102 controls. Using random effects meta-analysis, the pooled standardised effect size for the ABRC was 0.39 (95% CI: 0.05–0.73; $p=0.03$). There was significant heterogeneity between studies ($p<0.001$). Begg's test revealed that there was no evidence of a significant publication bias (coefficient = -5.01 ; $p=0.16$). However, the number of studies (9) used for this test is small and therefore the power to detect bias is limited (Begg and Mazumdar, 1994). Fig. 2 shows a forest plot with the main findings of the meta-analysis.

3.2. Local study

3.2.1. Analysis of the a–b ridge count in our sample of families

The mean a–b ridge counts were found to be similar for the patients, relatives and controls as can be seen in Table 2. There was no significant effect of group on the a–b ridge count [$F(2,219)=09.87$; $p=0.42$], so no further post hoc group comparisons were conducted.

3.2.2. Is there a relationship between total a–b ridge count and obstetric complications amongst our patients?

As can be seen in Table 2, the relationship between a–b ridge count and OCs was examined in a subsample of 96 patients whose mother agreed to be interviewed. Patients without obstetric complications did not differ significantly from controls in ABRC. Compared to controls, those patients who suffered definite obstetric complications had significantly reduced ABRC [$p=0.01$; regression coefficient = -4.91 ; 95% CI: -8.77 to -1.05].

4. Discussion

Our meta-analysis confirmed that patients with schizophrenia have reductions in their a–b ridge count that are statistically significant yet of mild severity (effect size of 0.39). As can be seen in Fig. 2, the study by Turek (1990) substantially deviates from the remaining primary studies. The meta-analysis exclud-

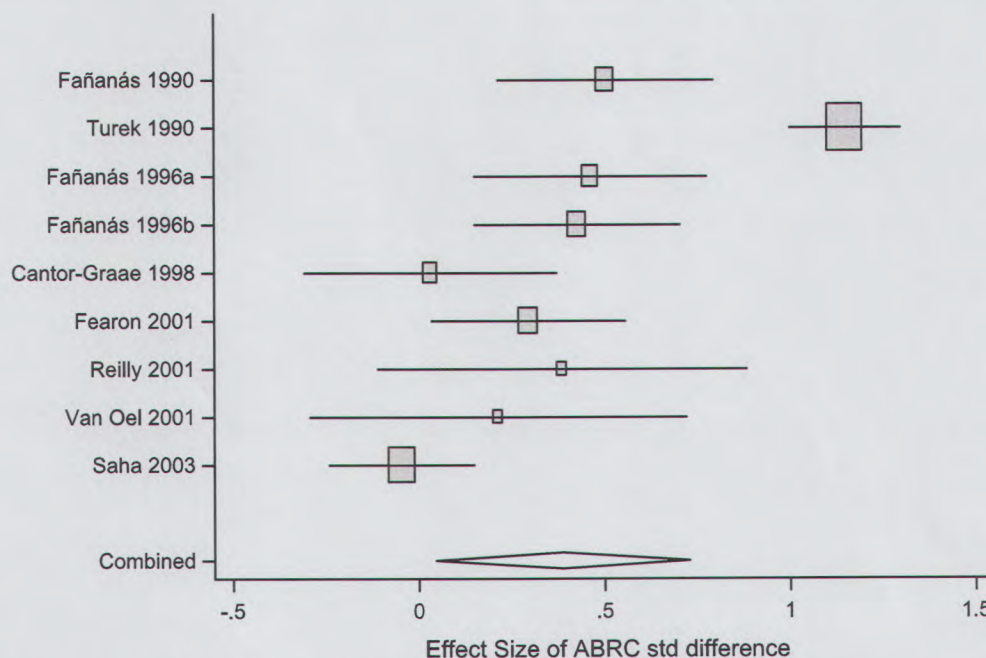


Fig. 2. Forest plot for meta-analysis of published studies of the ABRC in schizophrenia. The above forest plot shows nine previously published studies on the a–b ridge count comparing schizophrenia and controls. The horizontal lines represent 95% CI for each individual study. The size of the squares represents the weight given to each study in the meta-analysis. The diamond shows the pooled standardised effect sizes (PSES) of all nine studies using meta-analysis tools in STATA 7.0. The PSES was 0.39 (95% CI: 0.05–0.73; $p=0.03$). Thus, this meta-analysis shows that patients have a statistically significant yet modest reduction in ABRC compared to controls.

Table 2
ABRC by group

Comparison	Mean ABRC (S.D.) by group	Statistical comparisons
Effect of group on ABRC ^a	Controls, <i>n</i> =98	81.1 (11.6)
	Relatives, <i>n</i> =107	79.6 (10.3)
	Patients, <i>n</i> =125	79.1 (10.6)
Effect of obstetric complications on ABRC ^b	Patients without OCs, <i>n</i> =48	81.06 (9.70)
	Patients with OCs, <i>n</i> =48	76.21 (11.44)

Subsidiary analysis of obstetric complications in the patients.

OCs: obstetric complications.

^a Linear regression with robust and cluster options accounting for the family clusters in the data.

^b Linear regression with two planned comparisons of each patient subgroup against controls.

ing this apparent outlier provides a smaller yet still significant effect size of 0.27.

Thus, we believe that the ABRC reductions in schizophrenia exist, but are just subtle deviations from the norm. It is also plausible that they are only present in certain subgroups of patients; possibly those with more severe forms of the illness (Cannon et al., 1994). If so, it is not surprising that our predominantly stable and high-functioning outpatients had normal a–b ridge counts. Similarly, and coinciding with findings by Rosa et al. (2000), our larger sample of unaffected relatives also had normal ABRC.

Twin studies consistently show that the ABRC is strongly influenced by non-shared environmental influences rather than being genetically determined (Bracha et al., 1991; 1992; Van Oel et al., 2001). Although, our design does not allow claims about causation of ABRC deviances, it seems interesting that only those patients who suffered obstetric complications showed abnormally reduced ABRC, while patients without obstetric events and unaffected relatives did not differ from controls. This supports the idea that the subtle a–b ridge count reductions described in schizophrenia could be related to early environmental insults like obstetric complications; which, as highlighted in the meta-analysis by Cannon et al. (2002), are more likely to occur to the patients than to their relatives or controls.

4.1. Limitations

Firstly, although our sample is large, it is not epidemiological. Secondly, our OC data were col-

lected by maternal interview and recall bias cannot be ruled out. Finally, because their mothers were not available for interview, we could not examine the association between ABRC and obstetric complications in relatives or in controls. It is therefore possible that the correlation between obstetric complications and reduced AB ridge count found in our patients may be in fact unrelated to schizophrenia. Replication in unaffected groups is required. We used the broad term OCs including any complications during pregnancy or delivery. Clearly, the link between perinatal complications and ABRC reductions (which must have taken place before the 16th week of pregnancy) seems less plausible (McNeil and Cantor-Graae, 1999). However, evidence exists where perinatal obstetric complications have been associated with insults occurring earlier in pregnancy, for example, foetal hypoxia (Nelson and Ellenberg, 1986; O'Callaghan et al., 1992; McNeil et al., 2000; Cannon et al., 2002).

In conclusion, we confirmed the presence of significant yet mild ABRC reductions in schizophrenia. These represent a subtle deviance from the norm and could be present in certain subsets of patients, particularly those who suffered early developmental insults.

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