0021-7557/06/82-01/33
Jornal de Pediatria

Descriptive study of the clinical and nutritional profile and follow-up of premature babies in a Kangaroo Mother Care Program

Olga Penalva,[1] José Salomão Schwartzman[2]

Abstract

Objective: To describe the profile of premature newborns participating in the Kangaroo Mother Care Program and the data from, and to verify possible correlations between these descriptive data.

Methods: A descriptive study of 70 children, 5-34 months old, born between April 1999 and 2002, with gestation age of 32.5 weeks, birth weight 1,560 g, participating in the Kangaroo Mother Care Program (modified for Brazil) for at least 3 days. They were discharged from Kangaroo Mother Care weighing around 3,000 g and followed-up to 1 year.

Results: Birth weight, gestational age and Apgar scores were determinants of better clinical, nutritional and motor outcomes as well as for enrollment on the Kangaroo Mother Care Program. During the second phase of the program 8.6% of the children were readmitted due to apnea. Exclusive breastfeeding started at a mean postconceptual age of 35.3 weeks and mean age postpartum of 18.6 days. By hospital discharge, children were at a mean age of 29 days, mean weight of 1,734 g and 85.7% were on exclusive breastfeeding. Predominant breastfeeding up to 6 months of age was observed in 60.3%. We initially identified motor disorders in 42.8% decreasing to 14.3% in the final review of records, including cerebral palsy (6.9%) and retarded motor development (6.9%).

Conclusions: Enrollment on the Kangaroo Mother Care Program, in common with data on breastfeeding and clinical outcomes were determined by gestational age and birth weight and were influenced by clinical conditions of each preterm infant. Kangaroo Mother Care proved itself a good breastfeeding instrument, but its role as an intervention for motor development must be better investigated.

J Pediatr (Rio J). 2006;82(1):33-9: Kangaroo Mother Care, preterm newborn, prematurity, child development.

Introduction

The Kangaroo Mother Care Program (KMCP) was pioneered in Colombia in 1978 and allows clinically stable preterm infants to be discharged from hospital early and be given outpatients follow-up.[1] Since then it has been implanted in many countries[2-5] and can be employed as an alternative to technology or as a facilitator of mother-child bonding.[1] Although it is applied in a variety of manners, skin-to-skin contact is universal and is used as a synonymous to the method.

In Brazil the method was first used in Santos and Recife at the start of the nineties,[6,7] but it was only in 1999 that the Health Ministry (HM) regulated it.[8]

The KMCP in Brazil[9] is a systematized initiative that combines intervention proposals aimed at development.[10] The method combines control of adverse environmental stimuli with babies positioning. The principal differentiating factors in the care given the preterm infants are the mothers' participation in day-to-day care of the newborn and the skin-to-skin contact. The support team work to improve the self-confidence and competence of the parents, enabling a more positive interaction between them and the child.[1,2,9]

1. Mestre. Pediatra, Universidade Presbiteriana Mackenzie, São Paulo, SP, Brasil.
2. Professor titular, Universidade Presbiteriana Mackenzie, São Paulo, SP, Brasil.

This work was of the Kangaroo Mother Care Program and *Ambulatório de Desenvolvimento Infantil* at the *Hospital Geral de Itapecerica da Serra* (HGIS) and to the *Programa de Pós-graduação em Distúrbios do Desenvolvimento* at the Universidade Presbiteriana Mackenzie.

Manuscript received Jan 11 2005, accepted for publication Oct 19 2005.

Suggested citation: Penalva O, Schwartzman JS. Descriptive study of the clinical and nutritional profile and follow-up of premature babies in a Kangaroo Mother Care Program. J Pediatr (Rio J). 2006;82:33-9.

The majority of studies have focused on KMCP as a method of neonatal "management",[2,4,6,9,11] with little attention being paid to the method as a technique for intervening in the development of the preterm infants.[10,12,13] Bearing in mind the variety of applications for KMCP in different countries, its recent systematization in Brazil (1999) and the few domestic results, we carried out this study aiming to describe the perinatal, clinical and nutritional profiles of the preterm infants enrolled on the KMCP and also the data from outpatients follow-up at least to 1 year of age and correlations between descriptors.

Methods

This retrospective descriptive research was conducted at the *Hospital Geral de Itapecerica da Serra* - SECONCI-OSS/SP (HGIS), a Health Ministry center of excellence for the Kangaroo Mother Care Program. The research was authorized by the Ethics Committee.

Two hundred and ninety-six preterm infants were admitted to the Premature infant Unit at HGIS from April 1999 to April 2002. Of these, infants were selected for the present study if they did not present perinatal/maternal risk factors for compromised development (LGA, SGA, bronchopulmonary dysplasia, malformations, genetic syndromes, severe asphyxia, meningitis, grade III or IV intraventricular hemorrhage (IVH) identified by cranial ultrasound during the first week of life. Babies were also excluded if they had been transferred from rooming-in, given traditional care or suffered death, and those who were younger than 5 months old.

The final sample comprised 70 children, 90% born at the HGIS and the remainder transferred at 1 day of age. Twenty-two of them were twins and 39 were male. Gestational age varied from 27.7 to 34.5 weeks, birth weights from 1,050 to 2,295 g and ages from 5 to 34 months. Fifty-eight children were followed-up until at least their first birthday.

Information was recorded on social, perinatal and nutritional parameters in addition to data on breastfeeding and outpatients follow-up. Functional and descriptive categories were adopted for motor development.

The variables studied and the quantitative data for the study sample are shown in Table 1. Bivariate analysis was performed using the Spearman Rank Order Correlation Coefficient, with significance starting at 95% ($p \leq 0.05$). The characteristics of the sample did not allow for multivariate analysis.

Application of the KMCP

In Brazil the KMCP is systematized into five mainstreams: newborn's positioning (in nests within the incubator);[12,14] environmental interventions (light, sound, pain-relief protocol);[15] family-centered interventions and[7,16] breastfeeding[17] in addition to the actual skin-to-skin contact. The kangaroo position consists of placing the baby vertically in the supine position against the mother's chest.

The KMCP is divided into three stages, the first two are in-hospital stages and the third is outpatients. The first stage takes place at the Intensive Care unit with intermittent skin-to-skin contact. During second stage, infants are transferred to the KMCP ward (once it has been confirmed that the mother-baby pair meet the eligibility criteria) where mothers and babies spend 24 hours together. The third stage begins after hospital discharge when babies are brought to consultation when they reach around 3,000 g.

After the KMCP discharge, children are followed up at the Development Clinic, where they are assessed for the quality of movements and posture and their motor skills are observed (at chronological and corrected age). All children identified with abnormal development receive postural guidance or treatment. Consultations are with a development pediatrician who is part of the Program team.

Results

Profile of the preterm infants on the KMCP at the HGIS

The mean age of the mothers was 24.6 years, with seven years' schooling and a predominance of a single living child (79%). Psychosocial aspects included the fact that the majority (77.3%) had been living as though married for 5.3 years, and 89.3% were in their first stable marital relationship.

Mean birth weights (1,560±269 g), GA (32.5±1.4 weeks), fifth minute Apgar score (8.8±0.9) and age (15.3±7.1 months) were similar for the preterm infants of each sex and 60% of them were delivered vaginally.

The duration of Neonatal Intensive Care Unit (NICU) stay was 15.6 days. Eight newborns (11.4%) exhibited recurrent apnea or severe infection during the neonatal period (antibiotic therapy > 21 days and/or use of vasoactive drugs); 17 (24.3%) infants were ventilated for 2.3 days, and 63 (90%) received oxygen therapy for 2.8 days.

The newborns had a minimum weight of 1,371 g, recovered birth weight at 16.7 days; and fasted for 1.6 days.

During the NICU stay, weight change was negative (-8 g/day). The second stage started at the age of 15.6 days. Weight at enrollment on the program was 1,532 g. Overall change in weight during continuous skin-to-skin contact (KMCP second stage) was 17.3 g/day (positive).

The length of mother-baby hospital stay on continuous skin-to-skin contact was 11.5 days. Six (8.6%) babies aged 24 to 49 days were readmitted to the NICU during second stage, due to apnea.

Exclusive maternal breastfeeding began at 18.6 days at a mean weight of 1,611 g and GA of 35.3 weeks.

At hospital discharge weight was 1,734 g, age 29 days and corrected GA was 36.4 weeks.

At hospital discharge 85.7% of the newborns were being exclusively breastfed, 2.9% were being breastfed with supplementation using expressed breastmilk by cup, and 11.4% went home being fed with breastmilk plus formula.

Table 2 shows the averages for the various variables studied, broken down by diet at hospital discharge. We observed that those newborns who were receiving formula

Table 1 - Variables studied for the study sample with 70 preterm infants in the KMCP

Variables	Unit	Min.	Max.	Mean	Standard deviation
Mother's age	years	14	43	24.6	7.4
Number of living children	–	0	7	1	1.5
Schooling years	years	0	11	7.04	3.4
Time of marital relationship	years	1	15	5.3	4.2
Birth weight	grams	1,050	2,295	1,560	269
Gestational age	weeks	27.7	34.5	32.5	1.4
Apgar in the first minute	–	1	10	6.8	2
Apgar in the fifth minute	–	7	10	8.8	0.9
Minimum weight	grams	930	1,810	1,371	230
Time to regain birth weight	days	5	33	16.7	5.9
Length of time in the ICU	days	2	40	15.6	9
Time fasting	days	2	40	1.6	2.96
Age at the start of MB	days	0	41	14.6	12.44
Age at the start of EMB	days	2	58	18.6	13.8
Weight at the start of EMB	grams	1,330	1,990	1,611	157
GA at the start of EMB	weeks	32	38.7	35.3	1.4
Weight gain at ICU	grams	-315	485	-28.7	171
Weight gain/day at the ICU	grams	-56	12	-8	16
Age at the start of KMCP	days	2	40	15.6	9
GA at the start of total KMCP	weeks	30	38	34w4d	1.5
Weight at the start of total KMCP	grams	1,115	1,990	1,532	197
Time of total KMCP	days	4	39	11.5	7.6
Weight gain during total KMCP	grams	5	790	222	173
Weight gain/day during total KMCP	grams/day	1	58	17	9
Time on total KMCP	days	4	45	13	9
Weight gain in the second phase	grams	-60	790	210	177
Weight gain/day in the second phase	grams/day	3.75	58	17.3	9
Age at hospital discharge	days	7	74	29	16
Corrected GA at hospital discharge	weeks	33	41	36.4	1.67
Weight at hospital discharge	grams	1,470	2,220	1,734	162
Time in the third phase	days	23	136	52	23
Number of outpatient follow-up visits	–	2	15	7.9	3.2
Weight gain during the third phase	grams	865	3,020	1,505	368.4
Weight gain/day during the third phase	grams/day	11	53	32	10
Weight at outpatient follow-up	grams	2,800	4,690	3,264	322
Age at outpatient follow-up	months and days	29 days	3m21d	2m15d	26 days
Number of readmissions	–	1	2	1.1	0.38
EMB at the Development Clinic	months	0	8	3.5	2.2
MB at the Development Clinic	months	0	30	6.2	5.8
Hospital stays during the first year of life	–	0	2	0.1	0.3
Days of hospital stays during the first year of life	days	0	34	0.74	4.2
Age when orientation was provided	months	40 weeks	14	1.29	2.72
Corrected age when orientation was provided	months	40 weeks	12	0.8	2.1
Age at last consultation	months	5	34	15.3	7.1
Corrected age at last consultation	months	3	32	13.3	7

BW = birth weight; MB = maternal breastfeeding; EMB = exclusive maternal breastfeeding; GA = gestational age; KMCP = Kangaroo Mother Care Program.

supplements gained more weight. These children, however, spent almost twice as long in the NICU than the remaining children. During outpatients follow-up, weight gain was 32 g/day.

During the third stage, 19% of the patients were readmitted for many reasons: bronchiolitis, diarrhea, phototherapy, transfusion and herniorrhaphy.

The number of outpatients consultations varied from 2 to 15 (mean of 7.9). The length of outpatients follow-up was 52 days.

On discharge from the KMCP, weight was 3,264 g, and age oscillated from 29 days to 3 months and 21 days.

At discharge from the KMCP, 78% were on exclusive breastfeeding, 14% were being breastfed and given supplements and 8% were on formula.

During follow up babies remained on exclusive breastfeeding for 3.5 months, and 40.3% were breastfed for 5-8 months. The newborns on exclusive breastfeeding who received supplementation continued on mixed breastfeeding for 6.2 months. The expected fall-off in exclusive maternal breastfeeding rates was observed: from 88.6% at hospital discharge (1 month of age) to 78% at KMCP (third stage) discharge (3 months), and 36.8% at 6 months of age.

The following intercurrent clinical conditions were recorded: respiratory diseases (bronchospasm, pneumonia, upper airway infections and bronchiolitis) in 54.2% of cases, and non-respiratory diseases (acute gastroenterocolitis, acute otitis media, urinary tract infections and gastroesophageal reflux) in 29.9%. Upper airway infections were responsible for 18.6% of all respiratory diseases. Seventeen percent were hospitalized during their first year of life for intercurrent clinical conditions.

Although 92.5% (49/53) infants had normal cranial ultrasound, 12.2% (6/49) of them exhibited motor development problems. On the other hand, just one of four infants with abnormal cranial ultrasound findings exhibited motor development disorders.

Initially, motor abnormalities were observed in 42.8% (30/70) of the newborns, but in the majority of them resolved during the follow-up period.

Nineteen (of 30) children exhibited tonus abnormalities, 73.6% of whom achieved normal motor status. Among the others, three (15.8%) maintained tonus abnormalities, one child presented motor development delay (5.3%) and another who had abnormal tonus with pathological reflexes later developed diplegia (5.3%).

At 1 year of age 58 children were being followed (12 were lost to follow-up) and normal motor development was observed in 86.2% (50/58) of them. We identified abnormal motor function in eight cases (two with diplegia, one with athetosis, one with hemiplegia and four with motor development delay). Out-born infants (10% of the sample) accounted for 37.5% (3/8) of the children with motor abnormalities, even though they were transferred in on the first day of life.

Correlations between descriptors

Maternal social parameters: The mothers with more years' schooling had fewer children ($p = 0.004$) and had been in stable marital relationships for a shorter period ($p = 0.033$). Their infants gained more weight at the clinic ($p = 0.045$), spent less time in outpatients follow-up ($p = 0.040$) and were discharged from the program earlier ($p = 0.003$).

An increased number of marital relationships was a predictor for hospital discharge with formula supplementation ($p = 0.002$), for leaving the program using formula ($p = 0.000$) and for shorter periods under outpatients follow-up.

Type of delivery: preterm infants who were delivered by caesarian section exhibited lower weights and lower first and fifth minute Apgar scores. Severe neonatal

Table 2 - Diet at hospital discharge according to KMCP

Variables	Diet		
	EMB	MB+EBC	MB+AM
Age at the start of KMCP (days)	14	14	31
Period in total KMCP (days)	13	18	14
Time of ICU stay (days)	14	14	31
Weight gain at the ICU stay (grams)	-55	15	157
Weight gain at total KMCP (grams)	197	140	310
Weight at total KMCP (grams)	1,528	1,615	1,553
Weight at hospital discharge (grams)	1,716	1,702	1,864

KMCP = Kangaroo Mother Care Program; EMB = exclusive maternal breastfeeding; MB = maternal breastfeeding; EBC = expressed breastmilk by cup; AM = artificial milk.

infections were more common in this subset and these babies spent longer in the NICU and began the KMCP later. All of these findings were statistically significant ($p < 0.05$).

Birth weight: There was a positive correlation between BW and GA ($p = 0.000$), first minute Apgar score ($p = 0.015$), normal cranial ultrasound results ($p = 0.034$), normal motor status ($p = 0.038$), minimum weight index ($p = 0.000$), weight at start of KMCP ($p = 0.000$) and weight on hospital discharge ($p = 0.004$). A negative correlation was identified between BW and recurrent apnea ($p = 0.031$) severe infection ($p = 0.019$), age of BW recovery, length of NICU stay, age at program start, time spent on program and weight gain on KMCP, age on hospital discharge ($p = 0.000$), and the number of outpatients appointments ($p = 0.030$). Correlations with GA were similar.

Mechanical ventilation and oxygen therapy: The time spent on mechanical ventilation (17/70) was significantly shorter the older the GA ($p < 0.001$) and BW ($p = 0.010$). In contrast, this parameter had a positive correlation with all of the other variables studied (severe neonatal infections, tonus abnormalities, time spent in the NICU and on the KMCP, readmissions during stage three and age and corrected age at last consultation). The same statistically significant correlations were observed when the length of time on oxygen therapy was analyzed, with the exception of tonus abnormalities.

Breastfeeding: The younger the age at which exclusive maternal breastfeeding was started, the heavier the BW ($p = 0.000$), the older the gestational age ($p = 0.000$), the higher Apgar scores at the first ($p = 0.001$) and fifth minute, the heavier the minimum weight and weight at start of KMCP ($p = 0.000$). The remaining variables (recurrent apnea and severe infection, fasting time, delay to regain BW, length of time in the NICU, change of weight in the NICU, readmissions during the second stage of the program, start age and time on KMCP and age at hospital discharge) exhibited a positive correlation, retarded the start of exclusive maternal breastfeeding and increased the frequency of hospital discharge on a mixed diet ($p = 0.000$). At hospital discharge, an increased frequency of mixed feeding had a positive correlation with caesarian section delivery ($p = 0.032$), severe infection ($p = 0.012$), increased fasting time ($p = 0.018$), length of hospital stay at the NICU ($p = 0.000$), and abnormal motor status ($p = 0.005$).

Kangaroo Mother Care: Younger ages at the start of KMCP were associated with increased frequency of hospital ($p = 0.000$) and outpatients discharges ($p = 0.027$) on exclusive maternal breastfeeding.

Motor development: Older gestational ages were reflected in a reduced frequency of abnormal motor status ($p = 0.036$) and motor development delay ($p = 0.006$).

Abnormal cranial ultrasound results were related with lower BW ($p = 0.035$) and lower first ($p = 0.046$) and fifth ($p = 0.015$) minute Apgar scores also reflected an increased frequency of posterior retraction of the thigh ($p = 0.000$) and diplegia ($p = 0.023$).

When split according to place of birth, the subset of out-born babies exhibited an increased frequency of abnormal motor status ($p = 0.002$), motor development delay ($p = 0.012$) and persistent tonus abnormalities ($p = 0.002$).

Discussion

We compared our descriptive results with published data and also from two important reference centers for KMCP: the *Instituto Materno-Infantil de Pernambuco* (IMIP)[6] and the *Clínica del Nino* (CdN) in Bogota (Colombia).[9,16] Table 3 contains data from the three KMCP centers.

We observed a difference between the 8 g/day weight loss at the HGIS and the 5.9 g/day weight gain at the IMIP, although BW was heavier, GA was lower at the HGIS, compared with the IMIP. We identified a significant negative correlation between GA and weight gain at the NICU, and also that babies with lower GA spent longer time in intensive care, which could explain this difference.

The difference in length of hospital stay on the KMCP at the HGIS (11.5 days) and the IMIP (19.4 days) could be explained by the lower BW of the babies at the IMIP. It would be corroborated by a significant negative correlation between BW and time on the KMCP.

There were six cases of readmission (8.6%) to our NICU during the second stage of the program due to apnea. In a study at the IMIP, readmission rates of 12% were reported, with 9.5% requiring emergency interventions. The CdN reported that readmissions were similar in number to the control group.

There was no information on the age at which babies began exclusive breastfeeding at the IMIP or the CdN. The babies at the HGIS started exclusive breastfeeding with a mean age of 18.6 days and GA of 33.1 weeks, similar to a Swedish study (1999) with preterm infants[7] receiving conventional care, where exclusive breastfeeding began at 19 days with GA of 32.5 weeks.

Considering that this population at high risk of weaning, we observed elevated percentages of exclusive maternal breastfeeding at hospital discharge at both the HGIS and the IMIP. These rates are also comparable with the Swedish study[7] (80%). Note that the BW of the Swedish babies (2,074 g) was heavier than at the HGIS (1,565 g) and the IMIP (1,476 g), and that this may be an important differentiating factor.

Table 3 - Comparisons between studies with PTNB in the KMCP from the IMIP, CdN and HGIS

Data	IMIP	CdN	HGIS
Sample size (n)	114	679	70
Mean gestational age (weeks)	33.4	32 to 37	32.5
Cesarean delivery (percentage)	28%	68%	40%
Male (percentage)	46%	not informed	56%
Birth weight (grams)	1,476	1,685	1,565
Mean weight gain/day at the ICU (grams/day)	5.9	not informed	-8g
Mean weight at the start of the KMCP second phase (grams)	1,423	1,678	1,532
Mean time of mother-baby hospital stay in the KMCP (days)	19.4	not informed	11.5
ICU readmissions in the second phase of the KMCP (percentage)	12%	not informed	8.6%
Mean weight gain/day at the second phase of KMCP (grams)	15	not informed	17
Start of EMB (days)	not informed	not informed	18.6
Mean age at hospital discharge (days)	29.7	29	29
Mean weight at hospital discharge (grams)	1,677	1,685	1,734
EMB diet at hospital discharge (percentage)	88%	not informed	85.7%
EMB diet + EMC at hospital discharge (percentage)	7%	not informed	2.9%
EMB diet + AM at hospital discharge (percentage)	5%	not informed	11.4%
EMB diet at the first follow-up month (percentage)	87%	not informed	88.6%
EMB diet at the third follow-up month (percentage)	63%	not informed	78%
MB diet up to the first month of life (percentage)	not informed	98%	100%
MB diet up to the sixth month of life (percentage)	not informed	51.6%	60.3%

PTNB = preterm newborn; KMCP = Kangoroo Mother Care Program; EMB = exclusive maternal breastfeeding; EBC = expressed breastmilk by cup; MB = maternal breastfeeding.

Readmissions during the third stage (19%) were not related to the KMCP, early discharge did not result in a greater number of admissions than would be expected for low weight newborn.

The majority of the children (83%) were followed up at the Development Clinic for a period of 12 to 49 months, 12 children younger than 1 year were lost to follow-up, which may have affected the final results on motor development. We point out that, despite exhibiting the same profile as the remainder of the sample, these children were excluded from the final considerations.

Initially, motor abnormalities were identified in 42.8% of the newborns, although this percentage dropped to 13.8% during follow-up. This drop of 28.5% in abnormal motor test examination emphasizes the need for long-term follow-up. Since 1972, several authors have been describing transient motor abnormalities observed in preterm infants,[18] with frequency rates that oscillate from 36 to 83%. [19,20] The rate of tonus abnormalities (27.1%) observed in our study is inferior to indices reported in literature. This appears to become more obvious when we compare our findings with data from Silva & Oliveira,[20] who found that 44% of 94 preterm infants receiving traditional care and with GA of less than 35 weeks had tonus abnormalities.

With respect of the development of the preterm infants on the KMCP, two studies returned conflicting results. In the first study[16] by the CdN, Griffith test was applied at 1 year of age, finding that the newborn on the KMCP were similar to the control group. In the other[10] KMCP with intermittent skin-to-skin contact for 14 days, they found superior results at Bayley's test at 6 months corrected age.

Cerebral palsy rates on follow-up researches vary from 1.6 to 29% and are inversely related to GA.[16,18,21,22] In our sample 6.9% of the children had cerebral palsy, a higher frequency than we expected, since infants selected did not present perinatal/maternal risk factors for development. It is probable that inclusion of out-born infants increased this percentage and that their transportation may be an additional risk factor. Limitations of the first cranial ultrasound (with portable equipment) may be another factor that could have resulted in the inclusion of more severe intraventricular hemorrhage cases. Despite 92.5% of the cranial ultrasound results being normal, 12.2% of the newborn exhibited motor function abnormalities, including cerebral palsy. Mello et al. [22] found normal cranial ultrasound results in 82% of the cases, 18% of whom had motor abnormalities, with 20% of these last suffering from cerebral palsy.

We confirmed that for our sample, the lower the GA, the higher the frequency of abnormal motor status and motor development delay, with statistical significance. Lower BW, in turn, was also significantly correlated with increased frequency of abnormal cranial ultrasound findings and worse first and fifth minute Apgar scores. Gestational age and BW, therefore, were variables that can determine motor development. The possible influence of the KMCP on development in this study was restricted to a reduction in the rate of tonus abnormalities.

Both the descriptive data and the correlations found reassure that BW and GA are strong determinants for the preterm infants, guiding the application of the KMCP and influencing motor development.

Nevertheless, it appears to be out of the question that the KMCP offers a major contribution to preterm infants breastfeeding, when compared with other children receiving conventional care and general population.

We believe that this study has contributed to KMCP systematization modified for Brazil, with presentation of results to clarify doubts about the Program as well as basis for comparison with other researches.

Based on this descriptive study, further investigations should be undertaken to verify the possible influence of KMCP on motor development and on other aspects, such as psychoaffective, in which may rest the greatest contribution of KMCP.

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Correspondence:
Olga Penalva Vieira da Silva
Av. Padre Pereira de Andrade, 545/174-A
CEP 05469-900 – São Paulo, SP – Brazil
Tel./Fax: +55 (11) 3022.3465
E-mail: olgapenalva@terra.com.br