Asian Journal of Interdisciplinary Research | Volume 2 | Issue 1

FULL LENGTH ARTICLE

A Diagnostic Case Study of a Young Man with Russell-Silver Syndrome and Associated Comorbidities

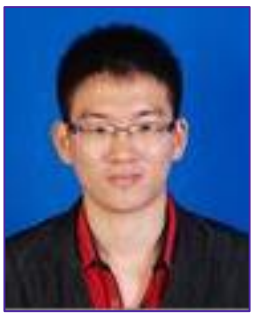
Boon Hock LIM [a,*], Ban Meng LEE [a], Benjamin Kee Ern LIM [a], Guo Hui XIE [b],

[a] Certified Educational Therapists, and BH Lim Special Needs Consultancy, Melaka, Malaysia.
[b] Board-Certified Educational Therapist and Special Needs Consultancy & Services, Singapore.
*Corresponding Author Email: bhlimspneeds@gmail.com
(Received: 18th October 2018; Revised: 10th November 2018; Accepted: 02nd January 2019)

Abstract: This is a case study of a young man diagnosed with Russell-Silver Syndrome or RSS for short (*Online Mendelian Inheritance in Man*® Classification Number #180860) and associated comorbidities. The aim of this paper is to provide diagnostic information about the syndrome with its comorbidities so that educational therapists and other allied professionals working with such individuals will know what to look out for, especially the RSS-associated comorbidities, and in that way, they become better informed in order to know what to offer in their Response to Intervention (RtI) for such individuals with RSS.

Key words:
Associated Comorbidities, Dwarfism, Russell-Silver Syndrome

Dr. Boon Hock LIM, a retired master biology teacher, is the founder of BH Lim Special Needs Consultancy. He is a certified special needs educational therapist and dialogic-diagnostic art therapists registered with the US-based International Association of Counsellors and Therapists. He also trains and supervises teachers, community workers, counsellors and therapists working with people with special needs.



Mr. Ban Meng Lee, a registered public accountant, has a mid-life career change to become a certified dialogic-diagnostic art therapist and special needs educational therapist registered with the US-based International Association of Counsellors and Therapists. He is currently working at BH Lim Special Needs Consultancy.

Mr. Benjamin Kee Ern LIM was an associate therapist working at BH Lim Special Needs Consultancy until end of October 2018.

Dr Guo-Hui Xie taught in both primary and secondary schools for eleven years before he left teaching for private practice as an educational therapist and counsellor in 1997. He is also an approved instructor/supervisor by the International Association of Counsellors and Therapists. Currently, he travels among the Asian countries to see clients with special needs and also to train resource teachers, community care workers, counsellors and therapists working with adults and children with special needs.

1. Introduction

Russell-Silver Syndrome (RSS) is "a rare genetic developmental disorder characterized by prenatal and postnatal growth delays and other physical abnormalities" (p.124) [1]. It has been listed in the *Online Mendelian Inheritance in Man*® (OMIM®) [2] under the category number #180860 with a different name known as Silver-Russell Syndrome (SRS) and its alternative names include Russell-Silver Syndrome and Silver-Russell Dwarfism, whose cytogenetic location is 7p11.2 and genomic coordinates (GRCh38) at 7:53,900,000-58,100,000. According to OMIM® [3] (see table), RSS has a phenotype mapping key 4 (i.e., a contiguous gene duplication or deletion syndrome in which multiple genes are involved) and the condition occurs in isolated cases.

As mentioned earlier, Russell-Silver Syndrome or RSS in short (also known as Silver-Russell Dwarfism or Silver-Russell Syndrome) is a disorder of slow growth before and after birth. Generally, such a child of either gender – male or female – is also found to have a low birth weight (i.e., below the population norm) and/or fails to gain weight at the expected rate (i.e., failure to thrive). When comparing with the rest of the body, the head growth is normal, but the head (i.e., the head circumference) may appear unusually large.

Moreover, children affected with Russell-Silver Syndrome (RSS) are observed to be thin and have poor appetites [2-3]. There are those who also develop recurrent episodes of low blood sugar (hypoglycemia) caused by feeding difficulties. For adults with RSS, they are short with an average height for affected men at about 151cm and an average height for affected women is about 140cm [2-3].

One noticeable feature in many children with RSS is their small, triangular face with distinctive facial features which include a prominent forehead, a narrow chin with a small jaw; and downturned corners of the mouth. In addition, according to The US National Library of Medicine [4], other RSS features include an unusual curving of the fifth finger (clinodactyly), asymmetric or uneven growth of some parts of the body, and digestive system abnormalities. RSS is also associated with a high risk of developmental delay in one or more the areas, i.e., adaptive behavior, cognitive capacity, communication, physical and motor development, and socio-emotional behavior, as well as speech-language problems, and learning disabilities [5].

2. A Brief Background Information about the Case

In this paper, the authors are presenting a case of a young adult diagnosed with RSS and associated comorbidities. The parents of a 27-year-old man, ML, approached the authors and requested for a case review of their son's condition. According to the parents, ML is an adopted son and also being the elder of the two boys. Since young, ML's parents had found him to be a very difficult child in terms of feeding (known as hypoglycaemia), challenging behavior (autistic and hyperactive) as well as moderate to severe delay in all the five domains of his developmental milestones: adaptive, cognitive (intellectual capacity), communication (language and speech), physical (motor skills), and socio-emotional (social interaction and emotional expression). The last condition indicated the presence of global developmental delay in ML,

As a result, ML's parents had sought professional help and advice from several medical practitioners and specialists in Malaysia concerning his rare condition. Later, on 1 June, 1992, they decided to bring the child to Singapore to seek medical advice from a

consultant pediatrician, who was then a professor of developmental pediatrics at the National University of Singapore but has since retired. The medical diagnosis provided by the medical consultant confirmed that ML was exhibiting symptoms typical of Russell-Silver Syndrome (RSS). Today, the widely accepted diagnostic criteria for RSS, according to Shayle [6], are based on the following three key symptoms:

(1) low birth weight (-2SD or below the 3rd percentile rank);
(2) continued growth restriction; and
(3) presence of characteristic facial features, including the following:
    (a) a head too large for body;
    (b) low positioning of facial features; and
    (c) a down-turned mouth; features such as those first described by Russell [7].

In the case of ML, the child met all the three criteria of the rare disorder when he was only one year old.

On 22 November 1995, ML's parents brought their child to see an occupational therapist at a center affiliated to the US-based Institutes for the Achievement of Human Potential (IAHP) in Kuala Lumper, for a further assessment and some follow-up treatment. According to the IAHP report, the child was diagnosed with profound diffuse bilateral midbrain and cortical brain injury. Later, on 4 December in the same year, ML's parents brought him to see a developmental pediatrician at the Hospital Melaka for a further medical endorsement of RSS with comorbid disabilities of mental retardation and/or severe developmental delays.

ML did not attend any mainstream school since young. In his earlier years, his parents had to teach him at home since he did not respond well to a typical preschool education. From his early childhood through adolescence and adulthood, ML has been attending a special education program at a center for special children run by a Christian welfare organization based in Melaka.

3. Results from Psycho-Educational Assessment, Evaluation and Profiling

The authors carried out a psycho-educational assessment on ML in addition to the previous standardized tests that had already been administered. In this section, the authors discussed the findings from the assessment.

3.1 Stanford-Binet Intelligence Scales-5th Edition (SB-5) [8]

Stanford-Binet Intelligence Scales-5th Edition (SB-5) [8] was chosen for administration as it is a wide-ranging, individually administered test battery. Its norms have been designed for ages 2 through 85+ years and the subtests cover five cognitive factors – Fluid Reasoning, Knowledge (Crystallized Ability), Quantitative Reasoning, Visual-Spatial Processing, and Working Memory – both in the verbal and nonverbal domains. The SB-5 was administered to determine ML's intellectual capacity. The SB-5 measures five cognitive abilities in both nonverbal and verbal formats with a total of ten subtests [8]:

a) Fluid Reasoning

It measures a student's ability to use inductive or deductive reasoning while solving both verbal and nonverbal problems.

b) Knowledge

It assesses your child's understanding of general information, vocabulary, social behavioural standards, and common sense that kids within the same age range are also expected to know.

c) Quantitative Reasoning

It assesses an individual's abilities with basic math concepts (such as identifying numbers and solving math word problems) as well as patterning, sequencing, ordering, classifying, comparing, and numerical problem-solving skills.

d) Visual-Spatial Processing

It measures each student's ability to identify patterns, relationships, spatial orientations, and how individual pieces relate to whole images on display as well as solve problems using pictures, images, diagrams, geometric shapes, maps or tables.

e) Working Memory

It assesses a child's ability to access information he or she has just seen or heard and how that data is inspected, transformed or sorted when answering a question or solving problems, such as repeating number and letter sequences in order, tapping blocks in a predetermined pattern or identifying visual and verbal absurdities shown on the test.

ML's SB-5 normed total and subtest scores are shown in Table 1 (Nonverbal/NV Domain) and Table 2 (Verbal/V Domain).

From the results, ML's Verbal Intelligence Quotient (VIQ) and Nonverbal Intelligence Quotient (NVIQ) are both in the moderately impaired or delayed intellectual capacity (i.e., in the range of IQ between 40-54). ML's standard scores for the five Nonverbal-Verbal (NV-V) subtests in SB-5 are tabulated in Table 3.

Table 1. SB-5 Nonverbal (NV) Subtest Raw and Scaled Scores:

Subtests	Raw Score	Scaled Score	Standard Score
NV-Fluid Reasoning	3	1	
NV-Knowledge	2	1	
NV-Quantitative Reasoning	3	1	
NV-Visual Spatial	4	1	
NV-Working Memory	1	1	
Total Sum of Scores for NVIQ	--	5	42
Percentile Rank			<0.1
95% Confidence Interval			39-51

Table 2. SB-5 Verbal Subtest Raw and Scaled Scores:

Subtests	Raw Score	Scaled Score	Standard Score
V-Fluid Reasoning	2	1	
V-Knowledge	2	1	
V-Quantitative Reasoning	3	1	
V-Visual Spatial	3	1	
V-Working Memory	0	1	
Total Sum of Scores for VIQ	--	5	43
Percentile Rank			<0.1
95% Confidence Interval			39-51

Table 3. SB-5 NV-V Subtest Sum of Scale Scores:

Subtests	Sum of Scaled Scores	Index Scores	Percentile Rank	95% Confidence Level
Fluid Reasoning	2	47	<0.1	44-60
Knowledge	2	49	<0.1	45-61
Quantitative Reasoning	2	50	<0.1	46-62
Visual-Spatial	2	48	<0.1	44-60
Working Memory	2	48	<0.1	45-61

ML's standard scores for four SB-5 quotients are shown in Table 4. Table 4 shows ML's SB-5 NVIQ-VIQ profile, where his NVIQ≡VIQ by a difference of 1 point. The minimum SB-5 NVIQ-VIQ difference of 9-10 points is required for significance at the .05 level. His NVIQ-VIQ profile is typical of individuals with extremely low intelligence i.e., he has intellectual and developmental disorder [8]. ML's FSIQ is 40 (where FSIQ<70) and it indicates that he shows moderately impaired or delayed verbal and non-verbal skills. Moreover, ML's FSIQ<AbIQ by a difference of 7 points. The minimum difference required for significance at the .05 level is 10-11 points as outlined in the SB-5 Test Manual [8].

Table 4. SB-5 Standard Scores for NVIQ, VIQ, FSIQ and AbIQ

Quotients	Standard Score	Percentile Rank	95% Confidence Interval
NVIQ	42	<0.1	39-51
VIQ	43	<0.1	39-51
FSIQ	40	<0.1	37-45
AbIQ	47	<0.1	44-60

Below is a brief description for each of the four SB-5 intelligence quotients (IQs) used in the assessment report [8]:

a) Nonverbal Intelligence Quotient (NVIQ)

This is the normed combined score taken from the five nonverbal subtests.

b) Verbal Intelligence Quotient (VIQ)

This is the normed combined score taken from the five verbal subtests.

c) Full Scale IQ (Full Scale Intelligence Quotient, or FSIQ)

This is the normed combined score taken from all 10 subtests.

d) Abbreviated Battery Intelligence Quotient (AbIQ)

This is to provide a quick estimate of two major cognitive factors: fluid reasoning and crystallized ability.

The AbIQ is used as its short administration time helps to minimize off-task behavior and maximize attention [8]. During the SB-5 administration, ML displayed very short attention-concentration span (and preferred to walk about than to sit down to complete given tasks) that interfered with the testing procedure. Hence, AbIQ offers a more valid estimate of ML's true intelligence and is representative of the full battery for him. However, according to the SB-5 Test Manual [8], care should be taken when interpreting the

AbIQ as it is likely to overestimate true abilities.

ML's Full-Scale IQ of 40, his AbIQ of 47 as well as his Nonverbal IQ of 42 and Verbal IQ of 43 based on SB-5 administration are all in the moderately impaired or delayed range (40 to 54).

3.2 Adolescent/Adult Sensory Profile (SP-A/A) [9]

The Adolescent/Adult Sensory Profile (SP-A/A) [9] was administered to identify ML's sensory processing patterns and effects on his functional performance in everyday activities (e.g., self-care, family relationships, bonding, job satisfaction/performance, school performance). Its questionnaire was completed by proxy, i.e., it allows ML's parents to answer the questions, since ML has difficulty understanding and that is no way he can complete a self-report. Clinical judgment is required to assist in the understanding of ML's sensory processing patterns and to design appropriate intervention strategies that can cater to his unique sensory needs.

As mentioned above, the SP-A/A (by proxy) was completed by ML's parents. The aim of the profile was to ascertain if ML has any sensory-related processing, modulation and/or emotional-behavioural problems that could have interfered with his thinking/learning. Moreover, it is also to find out ML's Sensory Profile factors (see Table 5) as well as the Sensory Profile summary of his sensory processing, modulation, and behavior and emotional responses to external/internal stimuli (see Table 6).

Table 5 above highlights one area of concern regarding sensation avoiding, whose result of 42/75 (based on 15 items) shows that ML manifests more of this sensory challenge than most people of his peer group. In the next table, i.e., Table 6, it will show which domains of processing ML will choose to avoid.

Table 5. Results of the Sensory Profile A/A Quadrant Factors

SP-A/A Quadrant Factors	Factor Raw Score Total	Description of Performance
Low Registration	33/75	Similar to most people
Sensation Seeking	54/75	Similar to most people
Sensory Sensitivity	41/75	Similar to most people
Sensation Avoiding	42/75	More than most people

Although ML is suspected to have pathological demand avoidant behavior (PDAB), also known as extreme demand avoidance (extreme demand avoidant behavior), no formal or informal test has been done to confirm this behavioral problem. Such challenging behavior has been found to associate with autism spectrum disorder [10]. Currently, the term PDAB does not have an official diagnostic code but has been observed in individuals with severe form of autism. The least severe form of PDAB is known as demand avoidant behavior (DAB).

Table 6 shows that ML's manifestations of low/active responses to taste/smell and touch processing, high/active responses to movement, visual and auditory processing; but high/passive response to activity processing. In other words, ML requires a low amount/intensity of stimuli (e.g., food) to activate his olfactory/gustatory/haptic awareness to respond/to be activated.

Table 6. A Summary of the SP-A/A Results

Quadrants	Scores	Neurological Threshold		Behavioral Responses		
		Sensory Sensitivity & Sensation Avoiding (LOW)	**L ow Registration & Sensation Seeing (HIGH)**	**Sensation Avoiding & Sensation Seeking (ACTIVE)**	**Low Registration & Sensory Sensitivity (PASSIVE)**	**Based on the highest mean scores**
Taste/Smell processing	Raw Score Total Mean	10 15 **0.67**	14 25 0.56	19 25 **0.76**	5 15 0.33	Low/Active
Movement processing	Raw Score Total Mean	4 20 0.20	11 20 **0.55**	10 15 **0.67**	5 25 0.20	High/Active
Visual processing	Raw Score Total Mean	17 30 0.57	12 20 **0.60**	17 25 **0.68**	12 25 0.48	High/Active
Touch processing	Raw Score Total Mean	21 35 **0.60**	12 30 0.40	18 30 **0.60**	15 35 0.43	Low/Active
Activity processing	Raw Score Total Mean	12 20 0.60	19 30 **0.63**	13 30 0.43	18 20 **0.90**	High/Passive
Auditory processing	Raw Score Total Mean	19 30 0.63	19 25 **0.76**	19 25 **0.76**	19 30 0.63	High/Active

He needs more intense stimuli to activate visual, auditory and movement processing of tasks given to him. This means that without keen sense of visual and/or auditory interest, ML will not follow through a given task to its completion. Hence, his praxis is weak. ML also needs a more intense stimulus than usual to get him involved in an activity to its completion, too.

A brief explanation for both sections on Neurological Threshold (NT) and Behavioral Response/Self-Regulation [9] is provided below:

a) Neurological Threshold (NT):
   i. Low NT means the individual is easily activated, requires a lower amount/intensity of stimuli to initiate awareness of and response to stimulus
   ii. High NT means the individual requires a more intense stimulus for

the central nervous system (CNS) to respond

iii. Functional performance of NT relies on a balance between low and high NTs

b) Behavioral Response/Self-Regulation (BR/SR)

i. Active BR/SR means the individual is active in counteracting NT, contradicts CNS response, and is based on genetics, experiences and task demands

ii. ii. Passive BR/SR means the individual tends to accept environment as it is, responds to environmental stimuli in accordance with NT, adopts methods that enable him/her to take some control over environment, but such BR/SR is unpredictable because behavior is influenced by ever-changing environment

3.3 Vineland Adaptive Behavior Scales-2nd Edition (VABS-2) [11]

Adaptive behavior refers to behavior that enables an individual to interact appropriately with his immediate environment with greatest success and least conflict with others. In other words, adaptive behavior relates to every day skills or tasks that ML is able to perform (similar to life skills).

Therefore, the focus of Vineland Adaptive Behavior Scale-2nd Edition (VABS-2) [11] was administered to assess ML's adaptive behaviors, including his ability to cope with environmental changes, to learn new everyday skills and to demonstrate independence. The primary purpose of the VABS-2 is to assess ML's social abilities and the age range for the VABS administration covers from preschool to 90 years [11]. The results reliably reveal crucial information for diagnosing various disabilities, including autism, Asperger syndrome, mental retardation, and speech impairment. Since adaptive behaviour is a composite of various dimensions, the VABS-2 measures the following five domains [11] as described below:

a) Communication Domain

It evaluates the receptive, expressive, and written communication skills of the child.

b) Daily Living Skills Domain

It measures personal behaviour as well as domestic and community interaction skills.

c) Socialization Domain

It covers play and leisure time, interpersonal relationships, and various coping skills.

d) Motor Skills Domain

It measures both gross and fine motor skills.

e) Maladaptive Behaviour

It is an optional part of the assessment test. It is used when measuring obvious undesirable behaviours.

Table 7 shows ML's VABS-2 results for four out of the five domains: Communication, Daily Living Skills, Socialization, and Maladaptive Behavior.

For ML, his adaptive behavior composite is low with v-Scale Score of 72 and Standard Score of 20 and a 95% confidence interval of 8 (>1%ile rank) based on the sums of domains standard scores. Hence, ML has severe difficulties in communicating effectively with others, living independently on his own and/or socializing appropriately with others around him.

Table 7. VABS-2 Results

Subdomain	v-Scale Score	Std Score	95% Confidence Interval	Percentile Rank	Adaptive Level	Age Equiv.	Strength (S) or Weak (W)
Receptive	1		±2		Low	1;07	
Expressive	1		±1		Low	2;01	
Written	4		±2		Low	5;06	S
Communication	6**	21	±9	<1%ile	Low	--	
Personal	5		±2		Low	5;10	
Domestic	4		±2		Low	5;11	
Community	1		±2		Low	3;11	W
Daily Living Skills	10**	31	±9	<1%ile	Low	--	S
Interpersonal Rels.	1		±2		Low	1;01	
Play & Leisure Time	1		±2		Low	0;06	
Coping Skills	3		±2		Low	1;06	S
Socialisation	5**	20	±9	<1%ile	Low	--	
Gross Motor Skills	--		--		--	--	
Fine Motor Skills	--		--		--	--	
Motor Skills	--	--	--	--	--	--	
Adaptive Behaviour Composite	72*	20	±8	<1%ile	Low	--	

Keys: *Represents sum of domain standard scores; **Represents sum of subdomain v-scale scores

Table 8. VABS-2 Scores

	Raw Score	v-Scale Score	95% Conf. Level	Level
* **Internalizing behavior**	10	22	±2	Clinically significant
* **Externalizing behavior**	8	20	±1	Elevated
* **Other behaviors**	9	--	--	--
Maladaptive Behavior Index	27	22	±2	Clinically significant

Table 8 provides the raw and v-scale scores for two out of three behaviors, i.e., internalizing and externalizing behaviors. From the results in Table 8, only the v-scale score for internalizing behavior is clinically significant while that for externalizing behavior is

elevated. The s-scale score for ML's Maladaptive Behavior Index (MBI) is 22 and it is clinically significant.

In other words, the above results shown in Table 8 suggest that ML has clinically significant challenging internalizing behavior (e.g., unable to modulate his inner feelings) and elevated issues of externalizing behavior (e.g., manifesting overtly self-injurious behavioral acts). His overall Maladaptive Behavior Index (MBI) of 22 ?2 is clinically significantly and warrants some form of individualized behavior support management plan to be designed and be properly implemented, catering to his needs.

3.4 Gilliam's Autism Rating Scale-2nd Edition (GARS-2) [12]

The Gilliam Autism Rating Scale-2nd Edition (GARS-2) [12] is a 42-item norm-referenced screening instrument used for the assessment of individuals who have severe behavioral problems that may be indicative of autism. Its purpose is to help professionals identify autism and it is also used to help educational teams determine whether the individual may meet criteria for receiving special education services under the autism category. It is important to clarify that this is not a medical diagnosis, but rather a category to receive special education services. The GARS-2 tool gathers information about specific characteristics typically noted in individuals with autism in three areas, i.e., Stereotyped Behaviors, Communication, and Social Interaction, as briefly described below [12]:

a) Stereotyped Behaviors

This first subtest is comprised of items 1 through 14. Items on this subtest describe stereotyped behaviors, motility disorders, and other unique and strange behaviors.

b) Communication

This second subtest contains items 15 through 28. These items describe verbal and nonverbal behavioral traits that are symptomatic of autism.

c) Social Interaction

This is the third subtest and is comprised of items 29 through 42. Items on this subtest evaluate the individual's ability to relate appropriately to people, events, and objects.

According to GARS-2 Examiner's Manual [12], the behavioral checklist of GARS-2 has been normed entirely of individuals diagnosed as autistic. Standard scores and percentiles are provided and the likelihood of autism can be determined. Table 9 shows ML's GARS results.

ML's Autism Index (AI) of 96, which is above AI of 85 or more, or subscale standard score of 7 or higher has a high or very likely probability of autism.

Table 9. GARS-2 Results

Subtests	Raw Score	Subscale Std Scores	Percentile Rank	SEM
• Stereotyped Behaviours	14	8	25	1
• Communication	16	9	37	1
• Social Interaction	25	11	63	1
Sum of Scaled Scores	--	28	--	--
Autism Index(AI)	--	96	39	4
Probability of Autism		Very Likely		

He is probably autistic. "Approximately 50% of the subjects with autism (based on the previous GARS) scored in this range" (p.17) [13].

3.5 Conners 3-Parent Short Form Assessment (Conners 3-P) [14]

The Conners 3rd Edition–Parent (Conners 3-P) [14] is an assessment tool used to obtain the parent's observations about the youth's behavior. This instrument is designed to assess Attention Deficit/Hyperactivity Disorder (ADHD) and its most common co-morbid problems in children and adolescents aged 6 to 18 years old [14]. Although it is not used with young adults, the criteria in Conners 3-P are still useful to identify young adults suspected to have ADHD. When used in combination with other information, results from the Conners 3–P can provide valuable information for guiding assessment decisions [14]. It is also important to be cautious when drawing unsupported interpretations. Combining information from Conners 3-P and information gathered from other psychometric measures, interviews, observations, and review of available records will give a more comprehensive view of ML than might be obtained from any one source.

Table 10 shows ML's results from Conners 3-P under six subscales below.

ML exhibits poor concentration and attention difficulty keeping his mind on work, makes careless mistakes, and easily distracted. He moves around a lot, fidgets, is restless and impulsive. He has problems with learning and/or understanding academic material that involves reading, spelling or mathematics skills. He needs extra explanations to help him to understand. ML also shows poor organization, loses things, difficulty getting started on given tasks.

He may have poor control of anger, may display physically and/or verbally aggressive behaviors including bullying. Moreover, he has difficulty with friendships, poor social connections and seems to be unaccepted by peers or others.

Table 10. Conners 3-P Results

Scale	T-Score	Guideline
Inattention	88	Very elevated score; many more concerns than are typically reported
Hyperactivity-Impulsivity	90	Very elevated score; many more concerns than are typically reported
Learning Problems	87	Very elevated score; many more concerns than are typically reported
Executive Functioning	66	Very elevated score; many more concerns than are typically reported
Defiance/Aggression	51	Very elevated score; many more concerns than are typically reported
Peer Relations	90	Very elevated score; many more concerns than are typically reported

4. Discussion of ML's Condition

Gathering all the essential information via interview provided by ML's parents and results obtained from the psycho-educational assessment, the authors are able to draw their conclusion concerning the comorbidities that co-exist with RSS. This conclusion is discussed briefly below using the 6-level pyramid of skills and abilities [15-16], as shown in Figure 1 below:

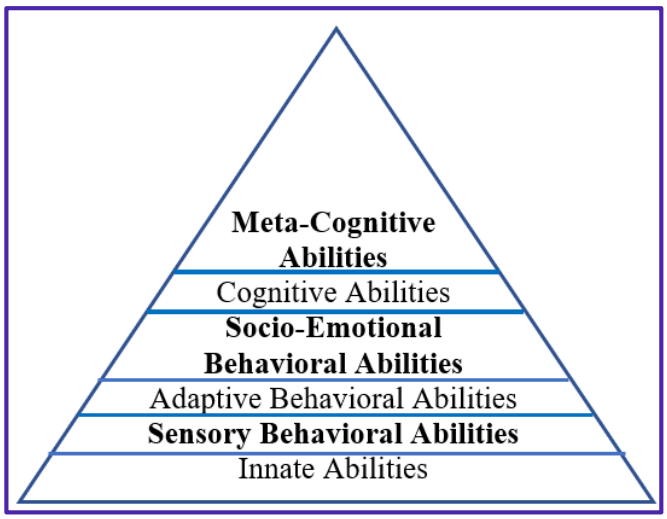


Figure1. 6-Level Pyramid of Skills & Abilities

Briefly, Level #1 concerns innate ability which include multiple intelligences such as abstract thought, understanding, communication, reasoning, learning, planning, emotional intelligence, and problem solving. Level #2 concerns sensory behavioral abilities which include exteroceptive senses, i.e., visual, auditory (aural and oral), haptic (tactile), olfactory and gustatory; and interoceptive senses, i.e., vestibular (balance and motion of body) and proprioception (position of body). Level #3 concerns adaptive behavioral abilities, i.e., sensory and motor skills, social skills, self-help skills, home living skills, independent living skills, language concepts, and academic skills. Level #4 concerns socio-emotional behavioral skills which include internalizing behaviors and externalizing behaviors. Level #5 are cognitive abilities which are listening, speaking, reading, writing, planning, counting, etc. Level #6 are meta-cognitive skills (e.g., self-monitoring and monitoring) which individuals are expected to attain at the higher level.

4.1 Medical Condition: Russell-Silver Syndrome

ML's medical condition of Russell-Silver Syndrome is first diagnosed by the consultant pediatrician/professor of developmental pediatrics at the National University of Singapore in 1992. Russell-Silver Syndrome (RSS), also known as Silver-Russell Syndrome, is a heterogeneous congenital disorder. It occurs between 1 in 50, 000 and 1 in 100,000 births [17] [18] with no racial bias, characterized by low birth weight due to intrauterine growth restriction (IUGR), continued short stature and facial dysmorphology (large forehead tapering to a small jaw). The predicted adult height of children with RSS without growth hormone treatment, is between 149.5 cm and 153.5 cm for males (-3.2SD) and between 138 cm and 147 cm for females (-2.5SD) [19] [20]. According to the US National Library of Medicine [4], "[A] dults with RSS are short; the average height for affected men is about 151 cm and the average height for affected women is about 140 cm" (para. 1). ML's current height of 147 cm falls within the range.

4.2 Level #1-Innate Abilities: RSS and Significantly Low Intelligence Quotient (IQ)

Individuals with RSS have been found to have a mean IQ score significantly below that of an age matched reference population and their siblings [21]. As a result, it is not surprising to note that "RSS is also associated with an increased risk of an age matched reference population and their siblings [21]. As a result, it

is not surprising to note that "RSS is also associated with an increased risk of delayed development, speech and language problems, and learning disabilities" (para. 2) [4].

ML's full-scale intellectual quotient (FSIQ) of 40 based on the SB-5 administration is less than 1%tile rank with the 95% confidence interval of 39-51 (see Tables 2, 3 and 5). His VIQ of 43 (<1%ile rank and 95% confidence level 39-51) and NVIQ of 42 (<1%ile rank and 95% confidence level 39-51) suggest that his Fluid Reasoning (Standard Score of 47), Knowledge (Standard Score of 49), Quantitative Reasoning (Standard Score of 50), Visual-Spatial (Standard Score of 48), and Working Memory (Standard Score of 48) are severely impaired at <1%ile rank with 95% confidence interval 39-51 (see Table 4).

4.3 Level #2a-Sensory Behavioral Abilities: RSS & Sensory Issues of Concern

Individuals with RSS do display poor sensory processing [1]. In terms of sensory issues, ML has shown some challenging problems with sensory avoidance (see Tables 5 and 6). His shows high neurological threshold levels for movement, visual, auditory and activity processing, i.e., more intense stimuli are needed in order for ML to respond, but he ends up counteracting all these stimuli with active behavioral responses/self-regulation (i.e., sensation avoiding & sensation seeking). He reacts passively (i.e., low registration & sensory sensitivity) to activity processing, i.e., he accepts it as it is but such behavioral responses/self-regulation are unpredictable due to changing environment. As for taste/smell and touch processing, ML is easily activated with lower intensity of stimuli but he is active in counteracting these stimuli in his behavioral responses and poor self-regulation.

4.4 Level #2b-Sensory Behavioral Abilities: RSS, Oral-motor Dysfunction & Hypo-glycaemia

According to Lai et al. [22], individuals with RSS are found to have speech difficulties, which can be a consequence of oral-motor dysfunction, and are related to the eating difficulties (especially, childhood hypoglycaemia) [17] [23-27]. According to ML's parents, when ML was still a toddler, he had childhood hypoglycaemia, which is observed in many of the young children with RSS [22]. As ML matures or grows older, he continues to manifest severe speech difficulties and he may utter one word or two in his typical conversation. Such oral-motor and speech delays seen in individuals with RSS, may account, in some cases, for the reported reductions in cognitive ability, with test scores being limited by physical and not cognitive ability [18].

4.5 Level #3-Adaptive Behavioral Abilities: RSS & Low Adaptive Behavioral Capability

Besides having a low intellectual capacity, ML is also found to have a clinically significant low Maladaptive Behavioral Index (MBI) due to motor, speech, and/or cognitive delays [5] (see Tables 7 and 8 for test results). This means that ML struggles to interact appropriately and successfully with his immediate environment without conflict with others. ML also displays poor every day skills or the ability to complete tasks given to him. In fact, he would choose to avoid tasks given to him to do and hence, he has been suspected to have demand avoidance behavior though no test has been done to confirm it.

4.6 Level #4a-Socio-Emotional Behavioral Abilities/Externalizing Behavior: RSS and Attention Deficit-Hyperactivity Disorder (ADHD)

RSS males have been found to have symptoms of both hyperactivity-impulsivity and inattention [6]. ML obtained very elevated scores for all the subscales in the Conners 3-P [14] indicating many more concerns than are typically reported (see Table 12). In fact, the most significant behavioral difficulty reported in individuals with RSS was hyperactivity/inattention, although other behavioral difficulties could be detected, these may be secondary to increased symptoms of Attention Deficit-Hyperactivity Disorder (ADHD) [28-29].

Results from both SB-5 and Conners 3-P also indicate that ML will continue to display severe learning problems throughout his lifespan development. According to Shayle [6], individuals with RSS will display greater difficulties in spatial tasks than in other areas, possibly reflecting difficulties with the tasks, rather than a true spatial deficit. Also, as an individual with RSS develops into adulthood, say at the age of 20, he may continue to display some fine motor coordination difficulties [6].

4.7 Level #4b-Socio-Emotional Behavioral Abilities/Externalizing Behavior: RSS and Autism Spectrum Disorder (ASD)

Individuals with RSS are encountering more social and communication difficulties, which are typical of those diagnosed with autism spectrum disorders (ASD), "and not social behaviors" (p.117) [6]. Shayle [6] reported an incidence of ASD in RSS would still be 3.3 in 100 or 33 in 1000, a 5-fold increase on the incidence reported in the general population. It can therefore be summarized that RSS is a risk factor for ASD. Besides, the reason why the authors administered GARS-2 [12] ML is that one of the clinical symptoms of RSS is being born Small for Gestational Age (SGA), which has previously been associated with a two-fold increase in the incidence of ASD [30-31]. Based on the GARS-2 results, ML has a high probability of autism with the Autism Index of 96 (see Table 9). However, his condition is not considered primary autism, but a syndromic autism. This is because, in ML's case, he manifests autistic behavioral traits which are "secondary to a known genetic syndrome" (p.4) [32] – Russell-Silver Syndrome.

5. Conclusion

With a low cognitive capacity to function normally and poor adaptive behaviour to lead an independent lifestyle, ML will require a lifetime support and supervision. His condition of RSS includes several comorbidities such as intellectual and developmental disorder (IDD) [21] which includes a clinically significant maladaptive behavior [5], attention deficit-hyperactivity disorder (ADHD) [6], sensory processing disorder (SPD) [1], syndromic autism [33] or autism spectrum disorder (ASD) [6] as well as oral-motor dysfunction which had previously caused childhood hypoglycaemia [25] and it is still affecting his speech production today.

ML's complex condition with its associated comorbidities can be summarized and presented in the following nosographic diagram (see Figure 2 below):

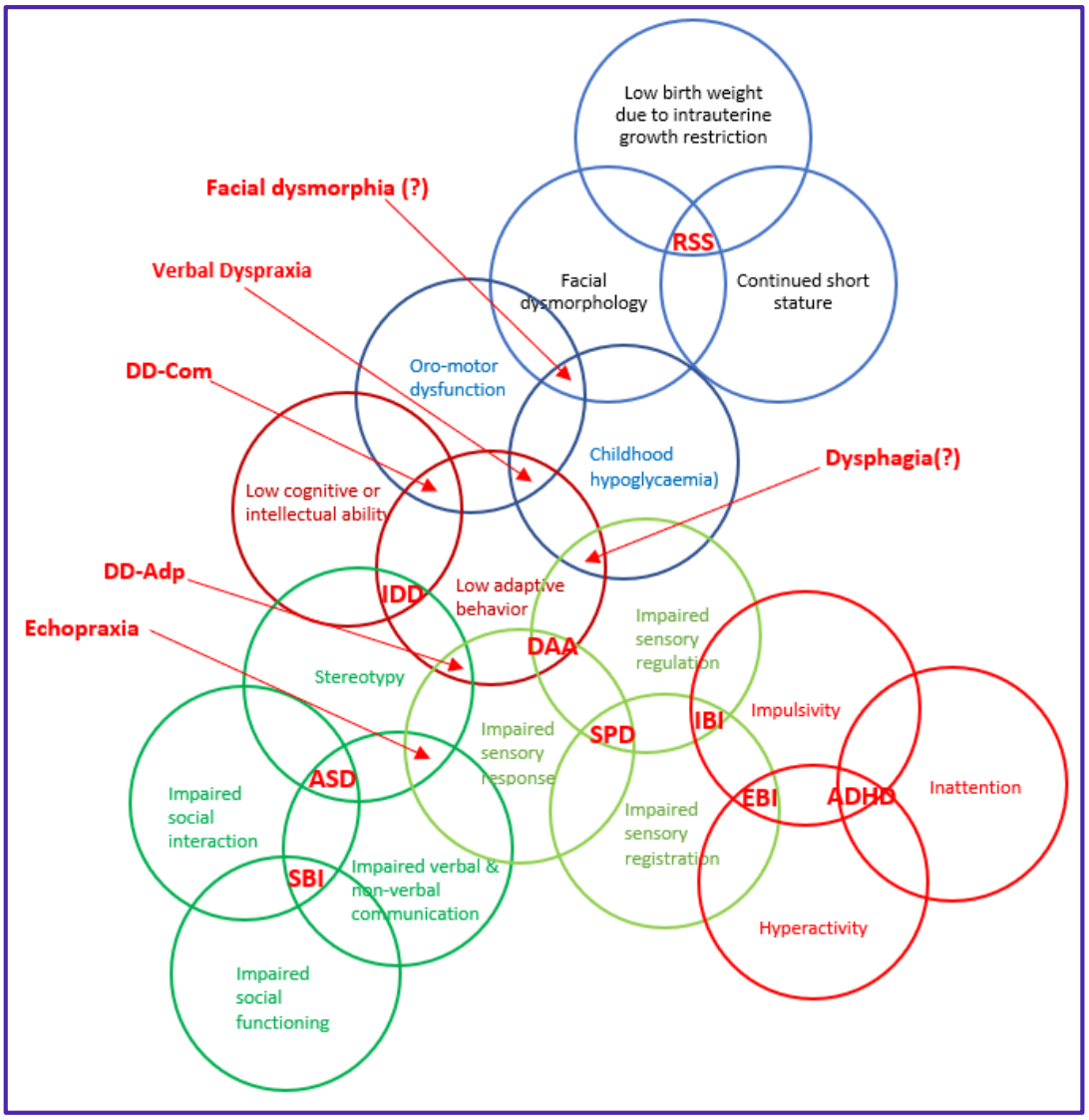


Figure 2. A Nosographic Representation of ML's RSS with Associated Comorbidities

(Note:? indicates a possible comorbid disability or disorder)

The following abbreviations have been used in Figure 2:

- ADHD: Attention Deficit/Hyperactivity Disorder
- ASD: Autism Spectrum Disorder (with RSS, it is syndromic autism)
- DAA: Comorbidity of Depression, Anxiety and/or Agitation
- DD-Adp: Developmental Delay-Adaptive Behavior Type
- DD-Com: Developmental Delay-Communication Type
- EBI: Excitatory Behavior Impairment
- IBI: Inhibitory Behavior Impairment
- IDD: Intellectual and Developmental Disorder
- SBI: Social Behavior Impairment
- SPD: Sensory Processing Disorder

6. References

[1] C.A. Plotts, C.L. Livermore, Russell-Silver syndrome and nonverbal learning disability: A case study. *Applied Neuropsychology*, 14 (2007) 124-134.

[2] M.B. Gross, (2015) Silver-Russell Syndrome (SRS), Retrieved [online] from: https://www.omim.org/entry/180860.

[3] Online Mendelian Inheritance in Man® (OMIM®) (2018). # 180860: Silver-Russell Syndrome (SRS). Retrieved [online] from: https://www.omim.org/entry/180860.

[4] The US National Library of Medicine (2018). Silver-Russell syndrome. Retrieved [online] from: https://ghr.nlm.nih.gov/condition/russell-silver-syndrome.

[5] New England Genetics Collaborative/Institute on Disability (2015). Russell-Silver syndrome at a glance. Retrieved [online] from: https://www.gemssforschools.org/sites/www.gemssforschools.org/files//library/pdfs_for_printing-dec2015/printable_rss-12.17.15.pdf.

[6] A.D.A. Shayle, (2009). Assessing the cognitive, behavioral and psychosocial profile of children with Russell-Silver syndrome, Unpublished PhD dissertation, College of Life and Environmental Science, University of Birmingham, UK.

[7] A. Russell, A syndrome of intra-uterine-dwarfism recognizable at birth with cranio-facial dysostosis, disproportionate short arms, and other anomalies: Five examples), *Proceedings of the Royal Society of Medicine*, *47*(1954) 1040-1044.

[8] G. Roid, (2003), Stanford-Binet Intelligence Scales: Fifth Edition*, Technical Manual*, And Itasca, IL: Riverside Publishing.

[9] C. Brown, W. Dunn, (2002) Adult/Adolescent Sensory Profile*, User's Manual*. San Antonio, CA: Psychological Corporation.

[10] E. Newson, K. Le Marechal, C. David, Pathological demand avoidance syndrome: a necessary distinction within the pervasive developmental disorders, *Archives of Diseases in Childhood*, *88* (2003) 595-600.

[11] S.S. Sparrow, D.V. Cicchetti, D.A. Balla, (2005) *Vineland Adaptive Behavior Scales, Second Edition(Vineland™-II)*, Circle Pines, *AGS Publishing*. MN.

[12] J.E. Gilliam, (2005). *Gilliam Autism Rating Scale (2nd Ed.) (GARS-2)*. Austin, TX.

[13] Gilliam, J.E. (1995). *Gilliam Autism Rating Scale (GARS)*. Austin, TX.

[14] C.K. Conners, (2008), *the Conners 3rd Edition–Parent (Conners 3–P)*, North Tonawanda, NY: Multi-Health Systems Inc.

[15] K.H. Chia, (2012) *Psychogogy*, Pearson Education, Singapore.

[16] K.H. Chia, (2015) *Psychogogy (2nd Ed.)*, Pearson Education, Singapore.

[17] J. Anderson, D. Viskochil, M. O'Gorman, C. Gonzales, gastrointestinal complications of Russell-Silver syndrome: A pilot study, *American Journal of Medical Genetics*, 113 (2002) 15-19.

[18] R.M. Perkins, M.T. Hoang-Xuan, The Russell-Silver syndrome: A case report and brief review of the literature, *Pediatric Dermatology*, *19* (2002) 546-549.

[19] J.M. Tanner, H. Lejarraga, N. Cameron, The natural history of the Silver-Russell syndrome: A longitudinal study of thirty-nine cases, *Archives of Disease in Childhood*, *50*, (1975) 611-623.

[20] H.A. Wollmann, T. Kirchner, H. Enders, M.A. Preece, M.B. Ranke, Growth and symptoms in Silver-Russell syndrome: review on the basis of 386 patients, *European Journal of Pediatrics*, *154* (1995) 958–968.

[21] M. Noeker, H.A. Wollmann, Cognitive development in Silver-Russell syndrome: a sibling-controlled study, *Developmental Medicine and Child Neurology*, *46* (2004) 340-346.

[22] K.Y.C. Lai, D. Skuse, R. Stanhope, P. Hindmarsh, Cognitive-abilities associated with the Silver-Russell syndrome, *Archives of Disease in Childhood*, *71* (1994) 490-496.

[23] S.M. Price, R. Stanhope, C. Garrett, M.A. Preece, R.C. Trembath, The spectrum of Silver-Russell syndrome: a clinical and molecular genetic study and new diagnostic criteria, *Journal of Medical Genetics*, 36 (1999) 837-842.

[24] J. Blissett, G. Harris, J. Kirk, Feeding problems in Silver-Russell syndrome, *Developmental Medicine and Child Neurology*, 43 (2001) 39-44.

[25] A. Falkert, K. Dittmann, B. Seelbach-Gobel, Silver-Russell syndrome as a cause for early intrauterine growth restriction, *Prenatal Diagnosis*, *25* (2005) 497-501.

[26] M.A. Preece, S.M. Price, V. Davies, L. Clough, P. Stanier, R.C. Trembath, G.E. Moore, Maternal uniparental disomy-7 in Silver-Russell syndrome, *Journal of Medical Genetics*, *34* (1997) 6-9.

[27] R. Stanhope, A. Albanese, C. Azcona, Growth hormone treatment of Russell-Silver syndrome, *Hormone Research*, *49* (1998)37-40.

[28] J. Biederman, Attention-deficit/hyperactivity disorder: A selective overview, *Biological Psychiatry*, *57* (2005) 1215-1220.

[29] K.R. Murphy, R.A. Barkley, T. Bush, Young adults with attention deficit hyperactivity disorder: Subtype differences in comorbidity, educational and clinical history, *Journal of Nervous and Mental Disease*, 190 (2002) 147-157.

[30] H.J. Larsson, W.W. Eaton, K.M. Madsen, M. Vestergaard, A.V. Olesen, E. Agerbo, P.B. Mortensen, Risk factors for autism: perinatal factors, parental psychiatric history, and socioeconomic status, *American Journal of Epidemiology*, 16 (2005) 916-925.

[31] C.M. Hultman, P. Sparen, S. Cnattingius, Perinatal risk factors for infantile autism, *Epidemiology*, *13* (2002) 417-423.

[32] R.H. Wozniak, N.B. Leezenbaum, J.B. Northrup, K.L. West, J.N. Iverson, The development of autism spectrum disorders: variability and causal complexity, *Wiley Interdisciplinary Reviews: Cognitive Science*, *8* (2017) 1-11.

[33] M.E. Reber, (2012) The Autism Spectrum (Cambridge Medicine (Hardcover)) 1st Edition, Kindle Edition, Cambridge University Press, UK.

Acknowledgement

The authors wish to thank the parents of ML for their kind consent to participate in this case study and also for the permission to use the assessment results in the publication of this paper for the purpose of professional sharing.

Funding

Nil

Competing Interests

The author declares to have no competing interests

About The License