|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author | Individual | Country | Age  (years)a | Sexb | Clinical remarks | Cytopenias | Immunoglobulins | Bone  marrow | Treatment | Outcome |
| Boztug,  2009 | P1 | Turkish | 6 | M | ASD  Cryptorchidism  Increased venous marking  Hepatoesplenomegaly | ANC 60-246 /μl  Intermittent thrombocytopenia | NA | Maturation arrest at the stage of promyelocytes/myelocytes | G-CSF  Cardiac surgery | Alive |
| Boztug,  2009 | P2 | Turkish | 3 | F | Cor triatriatum  Malformation of pulmonary veins  Increased venous marking  Hepato/esplenomegaly  Growth hormone deficiency | ANC 54-240/μl | NA | Maturation arrest at the stage of promyelocytes/myelocytes | G-CSF  Cardiac surgery | Alive |
| Boztug,  2009 | P3 | Turkish | 11 | F | ASD  Mitral insufficiency  Increased venous marking  Hepatoesplenomegaly | ANC 0-61/μl  Intermittent thrombocytopenia | NA | Maturation arrest at the stage of promyelocytes/myelocytes | G-CSF  Awaiting cardiac correction | Alive |
| Boztug,  2009 | P4 | Turkish | 6 | M | ASD  Cryptorchidism  Increased venous marking | ANC 0-322/μl | NA | Maturation arrest at the stage of promyelocytes/myelocytes | G-CSF  Cardiac surgery | Alive |
| Boztug,  2009 | P5 | Turkish | 4 | M | Increased venous marking  Poor growth | ANC 25-84/μl  Intermittent thrombocytopenia | NA | Maturation arrest at the stage of promyelocytes/myelocytes | G-CSF | Alive |
| Botzug,  2009 | P6 | Turkish | 6 | F | ASD  Pulmonary valve stenosis  Increased venous marking | ANC 90-612/μl | NA | NA | G-CSF | Alive |
| Boztug,  2009 | P7 | Greece | 7 | F | Inner ear hearing loss  Increased venous marking | ANC 30-1280/μl | NA | NA | G-CSF | Alive |
| Boztug,  2009 | P8 | Germany | 8 | F | ASD  Urachal fistula  Microcephaly  Increased venous marking | ANC 75-210/μl  Intermittent thrombocytopenia | NA | NA | G-CSF  Cardiac surgery | Alive |
| Boztug,  2009 | P9 | France | 9 | F | Myopathy  Increased venous marking | ANC 200-500/μl | NA | NA | G-CSF | Alive |
| Boztug,  2009 | P10 | Germany | 10 | M | ASD  Cryptorchidism  Genital dysplasia  Microcephaly  Inner ear hearing loss  Increased venous marking  Growth retardation | ANC 0-3.000/μl  Intermittent thrombocytopenia | NA | NA | G-CSF  Cardiac surgery | Alive |
| Boztug,  2009 | P11 | Persian | 11 | M | ASD  PDA | ANC 250-440/μl | NA | NA | G-CSF | Alive |
| Boztug,  2009 | P12 | Lebanese | 12 | M | Cryptorchidism  Bilateral inguinal hernia  Cleft palate | ANC 615-2000/μl | NA | NA | G-CSF | Alive |
| Eghbali,  2009 | P13 | Iran | 0 | M | Hydronephrosis of the left kidney  ASD and PDA | ANC 234/μl | IgG 672 mg/dl  (350-1180)  IgM 131 ml/dl  IgA 48 mg/dl  (36-165) | Maturation arrest in myeloid series | G-CSF | Alive |
| Dursun,  2009 | P14 | Turkish | 0.3 | F | ASD  Mild PH  Hypertelorism  Pectus carinatum  Hypoplastic thymus | ANC 300-630/μl  ALC 336-3800/μl  Platelets 141.000 - 222.000/μl  Hb 6.5 g/dl | NA | Hypocellularity with normal distribution of all series | NA | Deceased |
| Durson,  2009 | P15 | Turkish | 0.2 | M | ASD  Mild PH  Pectus carinatum  Cryptorchidism  Hypoplastic thymus | ANC 112-6000/μl  ALC 154-3680/μl  Platelets 35.000-446.000/μl  Hb 7.8 g/dl | NA | Dysplastic changes in all lineages, megaloblastic changes in myeloid and erythroid cell lines, severe vacuolization in myeloid series. | G-CSF 10 mcg/kg/day | Deceased |
| Arostegui,  2009 | P16 | Moroccan | 22 | M | ASD  Bilateral cryptorchidism  Prominent subcutaneous venous circulation  Poor growth | ANC 50-540/μl  Hb 9.5 g/dL | NA | Paucity of granulocyte series beyond the promyelocyte stage | rhG-CSF 7.5 mcg/kg every 48h | NA |
| Xia,  2009 | P17 | USA | NA | NA | ASD | Neutropenia  Intermittent thrombocytopenia | NA | NA | NA | NA |
| Xia,  2009 | P18 | USA | NA | NA | ASD  Coronary aneurysm | Intermittent thrombocytopenia | NA | NA | NA | NA |
| McDermott,  2010 | P19 | USA  (Caucasian) | 13 | M | Permeable foramen ovale  Mild PHT  Cryptorchidism  Prominent superficial veins  Sensorineural hearing loss  Heart valve abnormalities  Poor growth  Microcephaly  Ligamentous laxity  Bronchiectasias | ANC 50-900/μl | NA | Full myeloid maturation  Increased expression of CXCR4 | G-CSF 5 mcg/kg/day | Alive |
| McDermott,  2010 | P20 | USA  (Caucasian) | 9 | F | ASD  Prominent superficial veins  Poor growth  Microcephaly  Sensorineural hearing loss  Bronchiectasias | ANC 50-900/μl | NA | Full myeloid maturation  Increased expression of CXCR4 | G-CSF 5 mcg/kg/day | Alive |
| Germeshausen,  2010 | P21 | Turkish | 24 | F | Hypogonadotropic hypogonadism  ASD  Mild mitral and tricuspid insufficiency  Prominent superficial venous pattern  Learning difficulties | ANC 200-700 /μl  Thrombocytopenia | NA | NA | NA | Alive |
| Germeshausen,  2010 | P22 | Caucasian | 20 | M | Cryptorchidism  Genital dysplasia  Microcephaly  ASD  Prominent superficial venous pattern | ANC 0-30/μl  Thrombocytopenia | Hypogammaglobulinemia | NA | NA | NA |
| Germeshausen,  2010 | P23 | Caucasian | 5 | M | Neurodevelopmental abnormalities | ANC 300-350 /μl | NA | NA | NA |  |
| Hayee,  2011 | P24 | Pakistan | 20 | M | Recurrent oral ulceration | NA | NA | Normocellular with mild left-sided shift | NA | NA |
| Hayee,  2011 | P25 | Pakistan | 28 | M | ASD  Granulomatous IBD  Splenomegaly  Digital cubbing  Short stature | NA | NA | NA | NA | NA |
| Gatti,  2011 | P26 | Ecuador | 10 | M | ASD  Mitral and tricuspid regurgitation  Sensorineural hearing loss  Right-sided cryptorchidism  Prominent venous pattern | ANC 180/μl  Platelets 18.000/μl  Hb 9.6 g/dL | NA | Paucity of mature neutrophils, megakaryocyte hyperplasia | G-CSF 1.7 mcg/kg/day | Alive |
| Cullinane,  2011 | P27 | USA  (Caucasian) | 32 | F | ASD  Oculocutaneous albinism  IBD  Fine telangiectasias on arms and chest  Prominent superficial venous pattern on legs, varicose veins in legs  PH | ANC 0/μl  Platelets 21.000-57.000/μl | NA | Arrested neutrophil development, granulocytic precursors markedly increased | G-CSF | NA |
| Banka,  2011 | P28 | Israel | 29 | F | Small for gestation at birth  Mild learning disability  Prominent superficial venous pattern and varicose veins  Mild kyphosis  Clinodactyly  Hypothyroidism | ANC 700-1.300/μl  Platelets 38.000-140.000/μl | NA | Hypercellular marrow with myeloid hyperplasia. Increased number of megakaryocytes and blast-like forms | NA | Alive |
| Banka,  2011 | P29 | Israel | 26 | M | Small for gestation at birth  Agenesis of left kidney  Right kidney hydronephrosis  Mild learning disability  Prominent superficial venous pattern and varicose veins  Hypothyroidism | ANC 200-600/μl  Hb 9.9 gr/dL | NA | Mildly decreased myeloid cells.  Increased megakaryocytes. | NA | Alive |
| Banka,  2011 | P30 | Israel | 25 | F | ASD  PDA  Mild learning disability  Prominent superficial venous pattern and varicose veins  Poor growth  Delayed menarche | ANC200-1.500/μl  ALC 900-1.700/μl  Hb 10.8 gr/dL | NA | Decreased erythropoiesis, dysmyelopoetic changes with reduced granules in the cytoplasm and increased megakaryocytes | NA | Deceased |
| Banka,  2011 | P31 | Israel | 2 | M | Pulmonary valve stenosis  ASD and PDA  Cryptorchidism  Mild-moderate development delay  Prominent superficial venous pattern  Pectus carinatum  PH | ANC 400-7.700/μl  Monocytosis  Lymphopenia | NA | All stages of myelopoesis seen withput any myeloid maturation arrest | NA | Alive |
| Alizadeh,  2011 | P32 | Persian | 0.2 | M | ASD  Failure to thrive | ANC 40-170 /μl |  | Maturation arrest in myelocyte stage | G-CSF 5-10 mcg/kg/day | Deceased |
| Alizadeh,  2011 | P33 | Persian | 4 | M | ASD  Unilateral hydronephrosis  Prominent superficial venous pattern | ANC 28-450 /μl | NA | Maturation arrest in myelocyte stage | G-CSF 3-5 mcg/kg two times per week | Alive |
| Fernandez,  2012 | P34 | USA  (Caucasian) | 20 | M | ASD  Cryptorchidism  Oculocutaneous albinism  Mitral valve prolapse  Inflammatory bowel disease  Hepato/esplenomegaly | Intermittent thrombocytopenia  Neutropenia | NA | NA | G-CSF | Deceased |
| Smith,  2012 | P35 | Pakistan | 9 | M | ASD  IBD  Splenomegaly  Short stature | ANC 100/μl | NA | NA | G-CSF | Alive |
| Smith,  2012 | P36 | Turkey | NA | F | Patent foramen ovale  Tricuspid insufficiency | ANC<100/μl | NA | NA | G-CSF | Alive |
| Smith,  2012 | P37 | Pakistan | 13 | M | No abnormalities | ANC 400 /μl | NA | Normocellular morphology | G-CSF | Alive |
| Smith,  2012 | P38 | Pakistan | 3 | M | No abnormalities | ANC 450 /μl | NA | Normocellular morphology | G-CSF | Alive |
| Boztug,  2012 | P39 | Arab | 12 | F | ASD  Small PDA  Prominent superficial venous pattern  Discontinuous labia majora and minora | ANC 200/μl  Platelets 58.000-414.000/μl | NA | Left shift myelopoiesis, reduced numbers of mature neutrophils | G-CSF 5 mcg/kg alternate days | Alive |
| Boztug,  2012 | P40 | Hispanic | 9 | M | ASD  Prominent superficial venous pattern  Frontal bossing  Upturned nose  Bilateral cryptorchidism  Growth hormone deficiency | ANC 0-123/μl  Platelets 13.000-120.000/μl | NA | Left shift myelopoiesis, reduced numbers of mature neutrophils | G-CSF 3.3 mcg/kg three times per week | Alive |
| Boztug,  2012 | P41 | Caucasian | 9 | M | ASD  Prominent superficial venous pattern  Hypoplastic nipples  Micropenis  Erythropachydermia | ANC 100/μl | NA | Not done | G-CSF 3.7 mcg/kg three times per week | Alive |
| Boztug,  2012 | P42 | Caucasian | 11 | M | ASD  PDA  Bicuspid aortic valve  Prominent superficial venous pattern  Micropenis  Cryptorchidism  Erythropachydermia  Mild developmental delay | ANC 276/μl  Platelets 44.000-342.000/μl | NA | Left shift myelopoiesis, reduced numbers of mature neutrophils | G-CSF 5 mcg/kg three times per week | Alive |
| Boztug,  2012 | P43 | Caucasian | 7 | M | ASD  Prominent superficial venous pattern  Growth hormone deficiency  Triangular face  Left inguinal hernia | ANC 0-2.200/μl  Platelets 65.000-635.000/μl | NA | Hypocellular bone marrow, left shift of granulopoiesis with few mature neutrophils | Without G-CSF supplementation | Alive |
| Boztug,  2012 | P44 | Hispanic | 11 | M | ASD  Mitral and tricuspid regurgitation  Prominent superficial venous pattern  Right cryptorchidism  Bilateral inner ear hearing loss | ANC 180/μl  Platelets 16.000-553.000/μl | NA | Maturation arrest at myelocyte/promyelocyte stage | NA | Alive |
| Boztug,  2012 | P45 | Hispanic | 1 | M | ASD  Prominent superficial venous pattern  Ambiguous genitalia  Hydronephrosis  Triangular face | ANC 40/μl | NA | Maturation arrest at myelocyte/promyelocyte stage | G-CSF 4 mcg/kg alternate days | Alive |
| Boztug,  2012 | P46 | Caucasian | 16 | F | ASD  Prominent superficial venous pattern | ANC 300/μl |  | NA | G-CSF 5 mcg once weekly | Alive |
| Boztug,  2012 | P47 | Persian | 11 | F | ASD  Mild tricuspid regurgitation  *Cutis laxa*  Growth retardation  Triangular face | ANC 220/μl  Platelets 69.000-173.000/μl | NA | Maturation arrest at myelocyte/promyelocyte stage | G-CSF 5 mcg/kg once weekly | Alive |
| Boztug,  2012 | P48 | Hispanic | 12 | F | Small ASD  Prominent superficial venous pattern  Growth hormone deficiency  Triangular face | ANC 480/μl  Platelets 25.000-362.000/μl | NA | Maturation arrest at myelocyte/promyelocyte stage | G-CSF 8 mcg/kg alternate days | Alive |
| Boztug,  2012 | P49 | Hispanic | 14 | M | ASD  Prominent superficial venous pattern  Triangular face  Osteoporosis  Kawasaki disease  Growth retardation  Delayed puberty | ANC 60/μl  Platelets 30.000-420.000/μl | NA | Maturation arrest at myelocyte/promyelocyte stage | G-CSF 14 mcg/kg/day | Alive |
| Boztug,  2012 | P50 | Turkish | 0 | M | ASD  Prominent superficial venous pattern  Hydronephrosis  *Cutis laxa*  Triangular face  Frontal bossing  Micrognathia  Bilateral hearing loss  Growth retardation | ANC 41/μl | NA | Maturation arrest at myelocyte/promyelocyte stage | G-CSF 7 mcg/kg/day | Alive |
| Boztug,  2012 | P51 | Persian | 1 | M | ASD  Prominent superficial venous pattern | ANC 750-900/μl | NA | Maturation arrest at myelocyte/promyelocyte stage | G-CSF 3 mcg/kg alternate days | Alive |
| Boztug,  2012 | P52 | Caucasian | 18 | M | ASD  Bicuspid aortic valve  Prominent superficial venous pattern  Small kidneys  Cryptorchidism  Delayed puberty  Growth retardation  Massive splenomegaly | ANC<100/μl | NA | NA | G-CSF 7.5 mcg/kg alternate days | Alive |
| Boztug,  2012 | P53 | Pakistani | 1 | F | Hypoplastic left ventricle  Congenital ptosis  Growth retardation | ANC 200-400 | NA | Left shift myelopoiesis, strongly reduced numbers of mature neutrophils | G-CSF 5 mcg/kg 2 times per week | Alive |
| Boztug,  2012 | P54 | Caucasian | 7 | M | ASD  Prominent superficial venous pattern  Cryptorchidism  Right ptosis  Splenomegaly | ANC 200/μl  Platelets 97.000-332.000/μl | NA | Left shift myelopoiesis, strongly reduced numbers of mature neutrophils | G-CSF 12 mcg/kg three times per week | Alive |
| Aytekin, 2013 | P55 | Turkey | 13 | F | Mild mitral regurgitation  Frontal bossing  Depressed nasal bridge  Upturned nose  Retrognathia  Prominent superficial venous pattern on neck, chest, abdomen  Poorly developed secondary sexual characteristics | Hb 9.2 g/dL  ANC 200/μl | Normal | Myelokathexis  Hypercellular marrow with myeloid hyperplasia without maturation arrest | G-CSF 2.5 mcg/kg | Alive |
| Banka,  2013 | P56 | Pakistan | 10 | F | No prominent superficial venous  Normal echocardiogram | ANC 320-1.999/μl  Platelets 131.000-201.000/μl | NA | Normocellular marrow | G-CSF 4 mcg/kg | Alive |
| Banka,  2013 | P57 | Pakistan | 13 | F | No prominent superficial venous  Normal echocardiogram | ANC 280-1080/μl | NA | Normocellular marrow | Prophylactic  Co-trimoxazole | Alive |
| Banka,  2013 | P58 | Great  Britain | 8 | F | No prominent superficial venous  Normal echocardiogram | ANC 120-570/μl  Lymphocytes 1070-1100/μl | NA | Normocellular marrow | Prophylactic  Co-trimoxazole | Alive |
| Banka,  2013 | P59 | Great  Britain | 18 | F | No prominent superficial venous  Normal echocardiogram | ANC 110-670/μl  Lymphocytes 660-1150/μl | NA | Normocellular marrow | Prophylactic  Co-trimoxazole | Alive |
| Bégin,  2013 | P60 | Canada | 0.6 | F | Mitral valve insufficiency  Prominent superficial venous  IBD  Growth delay | ALC 600 /μl  (1.500-2.800)  T-cell lymphopenia | IgG 2340 mg/dl  (520-1520)  IgA 117 mg/dl  (65-400)  IgM 183 mg/dl  (22-280) | Normal hematopoiesis | G-CSG 5 mcg/kg  Prednisone  Infliximab | NA |
| Estévez,  2013 | P61 | Caucasian | 11 | M | Cryptorchidism  Prominent superficial veins | ANC 45-1.200 /μl  Intermittent thrombocytopenia | NA |  | G-CSF 5 mcg/kg/day | Alive |
| Alangeri,  2013 | P62 | Saudi Arabia | 12 | M | Asthma  Bicuspid aortic valve  Inguinal hernia | ANC 7-500/μl  Intermittent thrombocytopenia | NA | Active trilineage hematopoiesis, no evidence of granulocytic arrest. | G-CSF | NA |
| Alangeri,  2013 | P63 | Saudi Arabia | 10 | F | ASD  Aphthous stomatitis  Abdominal pain  Asthma | ANC 210/μl  Intermittent thrombocytopenia | NA | NA | NA | NA |
| Alangeri,  2013 | P64 | Saudi Arabia | NB | M | Septic shock | NA | NA | NA | NA | Deceased |
| Alangeri,  2013 | P65 | Saudi Arabia | 9 | F | Asthma | ANC 110-600/μl | Normal lymphocyte subsets | No maturation arrest | NA | NA |
| Alangeri,  2013 | P66 | Saudi Arabia | 2 | M | NA | ANC 180/μl |  | Active granulopoiesis with no maturation arrest | G-CSF | NA |
| Arikoglu, 2014 | P67 | Turkey | 3 | F | ASD and PDA  Frontal bossing  Depressed nasal bridge  Retrognathia  Prominent superficial venous pattern on chest and abdomen  Hepatomegaly  Bilateral cortical renal cysts  PH | ANC 600/μl  Hb 6 g/dL  Platelets 89000/μl | IgG 889 mg/dl (604-1940)  IgA 50 mg/dl  (26-296 mg/dl)  IgM 130 mg/dl  (71-235)  IgE < 17 KU/L  (0-100)  CD4+ T cells 260-436 mm3  (500-2400)  CD19+ T cells 80-166 mm3  (200-2100) | Normocellular marrow | G-CSF 5 mcg/kg | Alive |
| Kaya,  2014 | P68 | Turkey | 0.4 | F | Patent foramen ovale  Minimal tricuspid insufficiency  Pancolitis, IBD | ANC 80/μl | Normal | Normal | Pegfilgrastim 100 mcg/kg week | Alive |
| Kaya,  2014 | P69 | Turkey | 1 | F | ASD  Osteoporosis | ANC 100/μl | NA | NA | Pegfilgrastim 100 mcg/kg week | Alive |
| Desplantes,  2014 | P70 | France | NB | F | Aortic insufficiency  Grade III RVU, urethral duplication  Prominent veins  *Cutis laxa*  Frontal bossing  Thick lips  Hypothyroidism  Neurodevelopment difficulties  Leukemia | ANC 280/μl  Mild thrombocytopenia  Mild anemia | NA | NA | HSCT | Alive |
| Desplantes,  2014 | P71 | France | NB | M | ASD  Bilateral cryptorchidism  Hypospadias  Prominent veins  *Cutis laxa*  Frontal bossing  Thick lips  Neurodevelopment difficulties | ANC 383/μl | NA | NA | G-CSF | Deceased |
| Desplantes,  2014 | P72 | France | NB | F | ASD  Bilateral grade I RVU  Thick lips  Prominent veins  *Cutis laxa*  Neurodevelopment difficulties | ANC 411/μl  Mild thrombocytopenia  Mild anemia | NA | NA | G-CSF | Alive |
| Desplantes,  2014 | P73 | France | NB | M | PDA overriding aorta  Grade III RVU  Right cryptorchidism  Prominent veins  IBD  *Cutis laxa*  PH  Thick lips  Neurodevelopment difficulties | ANC 550/μl  Mild anemia | NA | NA | NA | Deceased |
| Desplantes,  2014 | P74 | France | NB | M | Cryptorchidism  Bilateral RVU  Megaureter  Prominent veins  *Cutis laxa*  Bilateral hearing loss  Prominent lips  Neurodevelopment difficulties | ANC 314/μl  Mild anemia | NA | NA | G-CSF | Alive |
| Desplantes,  2014 | P75 | France | 0.7 | M | Prominent veins  Kabuki syndrome like  Cerebral palsy | ANC 540/μl  Mild anemia | IgG 1870 mg/dl (608-1229)  IgA 170 mg/dl (33-200)  IgM 170 mg/dl (46-197)  CD3+ 1960 (2100-6200)  CD4+ 812 (1300-3400)  CD8+ 756 (490-1300)  CD19 364 (390-1400) | NA | G-CSF | Alive |
| Desplantes,  2014 | P76 | France | NB | M | Aortic insufficiency  Cryptorchidism  Micropenis  Prominent veins  IBD  Inguinal hernia | ANC 405/μl  Mild thrombocytopenia  Mild anemia | NA | NA | G-CSF  steroid | Alive |
| Desplantes,  2014 | P77 | France | NB | M | ASD  Aortic insufficiency  Cryptorchidism  Prominent veins  Umbilical hernia  Frontal bossing | ANC 410/μl | IgG 435 mg/dl (332-1160)  IgA 32 mg/dl (14-105)  IgM 34 (45-190)  CD3+ 1891 (2100-6200)  CD4 1178 (1300-3400)  CD8 682 (620-2000)  CD19 651 (720-2600) | NA | No treatment | Alive |
| Desplantes,  2014 | P78 | France | NB | F | Tricuspid regurgitation  Bilateral RVU  Bilateral deafness  NA | ANC 400/μl | NA | NA | No treatment | Alive |
| Desplantes,  2014 | P79 | France | 0.7 | F | ASD  PH  Broad nasal bridge | ANC 700/μl  Severe anemia | IgG970 mg/dl (768-1630)  IgA 170 mg/dl (68-378)  IgM 100 mg/dl (60-230)  CD3+ 378 (1200-2000)  CD4+ 252 (530-1300)  CD8+ 98 (330-920)  CD19+ 49 (110-570) | NA | G-CSF  steroid | Alive |
| Desplantes,  2014 | P80 | France | NB | F | ASD  Prominent veins | ANC 520/μl  Severe thrombocytopenia  Mild anemia | NA | NA | G-CSF | Alive |
| Desplantes,  2014 | P81 | France | 4.5 | M | ASD  Cryptorchidism  Prominent veins  Delayed puberty | ANC 160/μl  Mild anemia | NA | NA | NA | Deceased |
| Desplantes,  2014 | P82 | France | NB | M | Prominent veins  Pierre Robin sequence  Major intelectual disability | ANC 690/μl  Mild thrombocytopenia  Mild anemia | IgG1560 mg/dl (420-1090)  IgA 55 mg/dl (22-157)  IgM 70 mg/dl (45-263)  CD3+ 698 (1400-3700)  CD4+ 274 (700-2200)  CD8+ 332 (490-1300)  CD19+ 58 (390-1400) |  | G-CSF | Deceased |
| Notarangelo,  2014 | P83 | Italy | 13 | F | Mitral valve prolapse  Inguinal hernia  Hypergonadotrophic hypogonadism  Frontal bossing  Retrognathia  Prominent superficial venous pattern | ANC 200/μl  Mild anemia  Intermittent thrombocytopenia | IgG 1240 mg/dl (231-947)  IgA 54 mg/dl (8-74)  IgM 79 (26-210) | Global hypercellularity  Myeloid hyperplasia  Maturation arrest  Paucity of mature neutrophils | G-CSF 5-10 mcg/kg/day | NA |
| Notarangelo,  2014 | P84 | Turkey | 2 | M | Facial dysmorphisms  Prominent veins  Sensorineural hearing loss  Micropenis  Coronal hypospadias | ANC 60/μl | IgG 974 mg/dl (462-1710)  IgA 64 mg/dl (27-173)  IgM 118 mg/dl (62-257) | Delayed granulocyte maturation | G-CSF 5 mcg/kg 3 times a week | NA |
| Kiykim,  2015 | P85 | Turkey | 19 | M | ASD  Prominent superficial venous pattern  Osteopenia  Puberal delay  IBD-like  Bronchiectasis | ANC 500/μl  ALC 400/μl | IgG 2520 mg/dl (913-1884)  IgM 89 mg/dl  (88-322)  IgA 67 mg/dl  (139-378)  CD4+T cells 124/μl  (500-2000)  CD8+ T cells 140/μl  (200-1200)  CD 19+20 cells 20 /μl  (64-820)  CD16+56 8/μl  (100-1200) | Hypercellular bone marrow, mild dysplasia in granulocytic lineage | IVIG  TMP-SMX  Azathiopurine  Mesalazine  Testosterone | Alive |
| Kiykim,  2015 | P86 | Turkey | 11 | F | ASD and PDA  Osteoporosis  Prominent superficial venous pattern  Bronchiectasis | ANC 300/μl  ALC 1400/μl | IgG 2000 mg/dl  (835-2894)  IgM 237 mg/dl  (47-484)  IgA 56 mg/dl  (67-433) | Hypercellular bone marrow: left shift in granulopoiesis. Mild dysplasia in granulocytic lineage. | IVIG  G-CSF  TMP-SMX | Alive |
| Kiykim,  2015 | P87 | Turkey | 16 | F | Mild mitral valve insufficiency  Osteoporosis  Pubertal delay  Bronchiectasis | ANC 340/μl  ALC 1700/μl  CD19+20 85/μl  (120-740) | IgG 1930 mg/dl  (676-2197)  IgM 98 mg/dl  (75-448)  IgA 53 mg/dl  (108-447) | Mild dysplasia in granulocytic lineage.  Hyposegmented neutrophils and hypogranulation | IVIG  TMP-SMX | Alive |
| Mistry,  2017 | P88 | Great  Britain | 12 | M | Arthritis  IBD-like | Cyclic neutropenia  Normocytic anemia | Polyclonal increase in IgG and IgM | No defect in neutrophil production or maturation | Adalimumab | Alive |
| Bolton,  2019 | P89 | Great Britain | 1.4 | M | IBD | Neutropenia  ALC 490/μl | IgG 1660 mg/dl  (660-1.200) | NA | G-CSF for the first 20 years of life  HSCT | Alive |
| Case 1  (this report) | P90 | México | 0.3 | M | Low weight  Persistent foramen ovale  PH  Bilateral hydronephrosis  Prominent superficial veins in thorax, abdomen and limbs  Hepatomegaly  Cryptorchidism  Velopalatal insufficiency  Bilateral sensorineural hearing loss | ANC 100-800/μl  Intermittent thrombocytopenia  ALC 1400 /μl | IgG 398 mg/dl  (290-550)  IgM 114 mg/dl  (30-85)  IgA 44 mg/dl  (30-85) | Hypocellularity and maturation arrest of the myeloid development | G-CSF 5-22 mcg/kg/day  HSCT | Deceased |
| Case 2  (this report) | P91 | México | 15 | F | Bilateral sensorineural hearing loss  IBD  PH  Prominent superficial veins  Mild tricuspid insufficiency  Puberal delay | Intermittent neutropenia, nadir with 400 /μl  ALC 1000 /μl | IgG 396 mg/dl  (660-1220)  IgA mg/dl  (56-203)  IgM 77 mg/dl  (57-162)  IgE 36.6 mg/dl |  | G-CSF 10 mcg/kg/day  Mesalazin  TMP-SMX  Prednisone  IVIG every 21 days | Deceased |
| Case 3  (this report) | P92 | México | 0.3 | F | ASD and PDA  Tricuspid insufficiency  Prominent superficial veins  Bilateral sensorineural hearing loss  Severe pulmonary damage  PH | ANC 200 /μl  ALC 1300 /μl | IgG 2230 mg/dl  (240-440)  IgA 341 mg/dl  27-86)  IgM 77 mg/dl  (34-114) | Hypocellularity | G-CSF 30 mcg/kg/day  TMP-SMX  IVIG every 21 days | Alive |
| Case 4  (this report) | P93 | México | 9 | M | Persistent foramen ovale  PH  Left inguinal hernia.  Prominent superficial veins  Redundant skin folds in neck | ANC 450-790/μl  Intermittent lymphopenia and thrombocytopenia | NA | Cell hypoplasia | G-CSF | Alive |
| Case 5  (this report) | P94 | México | 2 | F | Bilateral conductive hearing loss | ANC 100 /μl  Intermittent lymphopenia and thrombocytopenia | IgG 918 mg/dl (340-620)  IgA 30.8 mg/dl  (33-122)  IgM 81 mg/dl  (48-143) | Hypocellularity | G-CSF 6  mcg/kg 4 days/week | Alive |

**Table 1. Demographic, clinical and laboratory features of 94 patients with G6PC3 deficiency**

a. Age at diagnosis or follow up

b. F, female; M, male, NA, not available

ASD, atrial septal defect; Hb, hemoglobin; ANC, absolute neutrophil count; ALC, absolute lymphocyte count; Ig, immunoglobulin; G-CSF, granulocyte colony-stimulating factor; PDA, persistent ductus arteriosus; HSCT, hematopoietic stem cell transplantation; PH, pulmonary hypertension; IVIG intravenous gammaglobulin; TMP-SMX, trimethoprim sulfamethoxazole; NB, newborn; IBD, inflammatory bowel disease

**Table 2. Genetic information of 94 G6PC3 deficient patients**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Author | Individual | Country or  ethnicity | Genotype | Protein change | Variant type | Syndromic |
| Boztug,  2009 | P1 | Turkey | c.[758G>A] | p.[Arg253His] | Missense, homozygous | Yes |
| Boztug,  2009 | P2 | Turkey | c.[758G>A] | p.[Arg253His] | Missense, homozygous | Yes |
| Boztug,  2009 | P3 | Turkey | c.[758G>A] | p.[Arg253His] | Missense, homozygous | Yes |
| Boztug,  2009 | P4 | Turkey | c.[758G>A] | p.[Arg253His] | Missense, homozygous | Yes |
| Boztug,  2009 | P5 | Turkey | c.[758G>A] | p.[Arg253His] | Missense, homozygous | Yes |
| Boztug,  2009 | P6 | Turkey | c. [554TT>C] | p. [Leu185Pro] | Missense, homozygous | Yes |
| Boztug,  2009 | P7 | Greece | c. [141C>G] | p. [Tyr47Ter] | Nonsense, homozygous | Yes |
| Boztug,  2009 | P8 | Germany | c. [784G>C] | p.[Gly260Arg] | Missense, homozygous | Yes |
| Boztug,  2009 | P9 | France | c.[677+1 G>A] + [829C>T] | p. [?] + [Gln277Ter] | Nonsense, comp.het? | Yes |
| Boztug,  2009 | P10 | Germany | c. [778G>C] | p. [Gly260Arg] | Missense, homozygous | Yes |
| Boztug,  2009 | P11 | Iran | c. [935dupT] | p. [Asn313fs] | Frameshift, homozygous | No |
| Boztug,  2009 | P12 | Lebanese | c. [144C>A] | p. [Tyr48Ter] | Nonsense, homozygous | Yes |
| Eghbali,  2009 | P13 | Iran | c. [935\_936insT] | p.[Asn313fs] | Insertion/Frameshift, homoz. | Yes |
| Dursun,  2009 | P14 | Turkish | c.[346A>C] | p.[Met116Val] | Missense, homozygous | Yes |
| Dursun,  2009 | P15 | Turkish | c.[346A>C] | p.[Met116Val] | Missense, homozygous | Yes |
| Arostegui,  2009 | P16 | Moroccan | c.[257delA] | p.[Glu86fs] | Frameshift, homozygous | Yes |
| Xia,  2009 | P17 | USA | NR | NR | NR | No |
| Xia,  2009 | P18 | USA | c.[210delC] | p.[170fsTer46] | Frameshift, homozygous | No |
| McDermott,  2010 | P19 | USA  (Caucasian) | c.[778G>C] | p. [Gly260Arg] | Missense, homozygous | Yes |
| McDermott,  2010 | P20 | USA  (Caucasian) | c.[778G>C] | p. [Gly260Arg] | Missense, homozygous | Yes |
| Germeshausen,  2010 | P21 | Turkish | c.[347T>A] | p. Met116Lys | Missense, homozygous | Yes |
| Germeshausen,  2010 | P22 | Caucasian | c.[778G>C] | p.[Gly260Arg] | Missense, homozygous | Yes |
| Germeshausen,  2010 | P23 | Caucasian | NR | p.[Arg189Gln] | Missense, homozygous | No |
| Hayee,  2011 | P24 | Pakistan | c.[130C>T] | p.[Pro44Ser] | Missense, homozygous | No |
| Hayee,  2011 | P25 | Pakistan | c.[190\_210del] | p. [Thr64\_Ile70del] | Small deletion, homozygous | Yes |
| Gatti,  2011 | P26 | Ecuador | c. [765\_delAG] | p.[Ser255fs] | Small del/Frameshift, homoz. | Yes |
| Cullinane,  2011 | P27 | USA  (Caucasian) | c.[986delC] | p.[Thr329ArgfsTer68] | SN del/Frameshift, homoz. | Yes |
| Banka,  2011 | P28 | Israel | c.[758G>A] | p.[Arg253His] | Missense, homoz. | Yes |
| Banka,  2011 | P29 | Israel | c.[758G>A] | p.[Arg253His] | Missense, homoz. | Yes |
| Banka,  2011 | P30 | Israel | c.[758G>A] | p.[Arg253His] | Missense, homoz. | Yes |
| Banka,  2011 | P31 | Israel | c.[758G>A] | p.[Arg253His] | Missense, homoz. | Yes |
| Alizadeh,  2011 | P32 | Persian | c.[416G>T] | NR | NR | No |
| Alizadeh,  2011 | P33 | Persian | c. [935dupT] | p.[Asn313fs] | Dup/Frameshift, homoz. | Yes |
| Fernandez,  2012 | P34 | Canada | c. [829C>T] | p.[Gln277Ter] | Nonsense, homozygous | Yes |
| Smith,  2012 | P35 | Pakistan | c.[190\_210del] | p.[Thr64\_Ile70del] | In-frame 21bp deletion, homoz. | Yes |
| Smith,  2012 | P36 | Turkey | c.[623T>G] | p.[Leu208Arg] | Missense, homozygous | No |
| Smith,  2012 | P37 | Pakistan | c.[130C>T] | p. [Pro44Ser] | Missense, homozygous | No |
| Smith,  2012 | P38 | Pakistan | c.[130C>T] | p. [Pro44Ser] | Missense, homozygous | No |
| Boztug,  2012 | P39 | Arab | c.[758G>A] | p.[Arg253His] | Missense, homozygous | Yes |
| Boztug,  2012 | P40 | Hispanic | c.[218+1G>A] | NR | Splice-site intronic, homoz. | Yes |
| Boztug,  2012 | P41 | Caucasian | c.[758G>C] | p.[Gly260Arg] | Missense, homoz. | Yes |
| Boztug,  2012 | P42 | Caucasian | c.[758G>C] | p p.[Gly260Arg] | Missense , homoz. | Yes |
| Boztug,  2012 | P43 | Caucasian | c.[208insC]+[778G>C] | p.[lle70fsTer16]+[Gly260Arg] | SN insertion/frameshift + Missense (comp.het) | Yes |
| Boztug,  2012 | P44 | Hispanic | c.[766\_777delAG] | p.[Ser255fs] | Frameshift, homozygous | Yes |
| Boztug,  2012 | P45 | Hispanic | c.[210delC]+[348G>A] | p.[lle70fsTer46] + [Met116lle] | Frameshift, homozygous | Yes |
| Boztug,  2012 | P46 | Caucasian | c.[677+1 G>A]+[829>T] | p.[?]+[Gln277Ter] | Splice-site intronic + Nonsense, (Comp.het) | Yes |
| Boztug,  2012 | P47 | Persian | c.[935dupT] | p. [Asn313fs] | SN dup/Frameshift, homoz. | Yes |
| Boztug,  2012 | P48 | Hispanic | c.[210deIC] | p.[Phe71fsTer45] | SN del/Frameshift, homoz. | Yes |
| Boztug,  2012 | P49 | Hispanic | c. [210deIC] | p. [lle70fsTer4] | SN del/Frameshift, homoz. | Yes |
| Boztug,  2012 | P50 | Turkish | c.[779G>A] | p.[Gly260Asp] | Missense, homoz. | Yes |
| Boztug,  2012 | P51 | Persian | c.[416G>T] | p. [Ser139lle] | Missense, homoz. | Yes |
| Boztug,  2012 | P52 | Caucasian | c. [482G>A] + [565C>T] | p. [Arg161Gln] + [Arg189Ter] | Missense + Nonsense, comp.het. | Yes |
| Boztug,  2012 | P53 | Pakistani | c. [766\_777delAG] | p. [Ser255fs] | Small del./Frameshift, homoz. | Yes |
| Boztug,  2012 | P54 | White caucasian | c. [131C>T] + [758 G>A] | p. [Pro44Leu]+[Arg253His] | Missense, comp.het. | Yes |
| Aytekin,  2013 | P55 | Turkey | c.[461T>C] | p.[Leu154Pro] | Missense, homozygous | Yes |
| Banka,  2013 | P56 | Pakistan | c.[130c>T] | p.[Pro44Ser] | Missense, homozygous | No |
| Banka,  2013 | P57 | Pakistan | c.[347T>C] | p.[Met116Thr] | Missense, homozygous | No |
| Banka,  2013 | P58 | Great Britain | c.[757C>T]+[1000\_1001] | p.[Arg253Cys] + [Met334fs] | Missense + Small del/Frameshift, comp.het. | No |
| Banka,  2013 | P59 | Great  Britain | c.[757C>T]+[1000\_1001] | p.[Arg253Cys] + [Met334fs] | Missense + Small del/Frameshift, comp.het. | No |
| Bégin,  2013 | P60 | Canada | c.[IVS3-1 G>A]+[G778G>C] | p.[?] + [Gly260Arg] | Splice-site intronic + Missense, comp.het. | Yes |
| Estévez,  2013 | P61 | Caucasian | c. [778G>C] | p.[Gly260Arg] | Missense, homozygous | Yes |
| Alangeri,  2013 | P62 | Saudi Arabia | c.[974 T>G] | p.[Leu325Arg] | Missense, homozygous | No |
| Alangeri,  2013 | P63 | Saudi Arabia | c.[974 T>G] | p.[Leu325Arg] | Missense, homozygous | No |
| Alangeri,  2013 | P64 | Saudi Arabia | c.[974 T>G] | p.[Leu325Arg] | Missense, homozygous | No |
| Alangeri,  2013 | P65 | Saudi Arabia | c.[974 T>G] | p.[Leu325Arg] | Missense, homozygous | No |
| Alangeri,  2013 | P66 | Saudi Arabia | c.[974 T>G] | p.[Leu325Arg] | Missense, homozygous | No |
| Arikoglu,  2014 | P67 | Turkey | c.[175T>C] | p.[Trp59Arg] | Missense, homozygous | Yes |
| Kaya,  2014 | P68 | Turkey | c. [623T>C] | p.[Leu208Arg] | Missense, homozygous | No |
| Kaya,  2014 | P69 | Turkey | NR | NR | NR | No |
| Desplantes,  2014 | P70 | France | c.[249G>A] | p.[Trp83Ter] | Nonsense, homozygous | Yes |
| Desplantes,  2014 | P71 | France | c.[249G>A] | p.[Trp83Ter] | Nonsense, homozygous | Yes |
| Desplantes,  2014 | P72 | France | c.[249G>A] | p.[Trp83Ter] | Nonsense, homozygous | Yes |
| Desplantes,  2014 | P73 | France | c.[249G>A] | p.[Trp83Ter] | Nonsense, homozygous | Yes |
| Desplantes,  2014 | P74 | France | c.[249G>A] | p.[Trp83Ter] | Nonsense, homozygous | Yes |
| Desplantes,  2014 | P75 | France | c.[758G>A] | p.[Arg253His] | Missense, homozygous | Yes |
| Desplantes,  2014 | P76 | France | c.[481C > T] | p.[Arg161Ter] | Nonsense, homozygous | yes |
| Desplantes,  2014 | P77 | France | c.[778G > C] | p.[Gly260Arg] | Missense, homozygous | Yes |
| Desplantes,  2014 | P78 | France | c.[778G > C] | p.[Gly260Arg] | Missense, homozygous | Yes |
| Desplantes,  2014 | P79 | France | c.[778G > C] | p.[Gly260Arg] | Missense, homozygous | No |
| Desplantes,  2014 | P80 | France | c.[565C > T] | p.[Arg189Ter] | Nonsense, homozygous | Yes |
| Desplantes,  2014 | P81 | France | c.[565C > T] | p.[Arg189Ter] | Nonsense, homozygous | Yes |
| Desplantes,  2014 | P82 | France | c.[565C > T] | p.[Arg189Ter] | Nonsense, homozygous | Yes |
| Notarangelo,  2014 | P83 | Italy | c.[144C>A]+[373\_375delAAT] | p.[Tyr48Ter]+[Ile125del] | Nonsense + In-frame del, comp.het. | Yes |
| Notarangelo,  2014 | P84 | Turkey | c.[680\_684delinsT] | p.[Ser227LeufsTer3] | Indel/Frameshift, homozygous | Yes |
| Kiykim,  2015 | P85 | Turkey | c. [535+1G>A] | NR | Splicesite intronic, homozygous | Yes |
| Kiykim,  2015 | P86 | Turkey | c. [935dupT] | p. [Asn313fs] | SN dup/frameshift, homoz. | Yes |
| Kiykim,  2015 | P87 | Turkey | c. [C394T] | p.[Glu132Ter] | Nonsense, homozygous | Yes |
| Mistry,  2017 | P88 | Great  Britain | c. [130C>T] | p.[Pro44Ser] | Missense, homozygous | Yes |
| Bolton,  2019 | P89 | Great  Britain | c.[911dupC] | p.[Gln305fs82Ter] | SN dup/frameshift, homozygous | No |
| C1 (this report) | P90 | México | c.[210delC] | p.[Phe71SerfsTer46] | SN deletion/frameshift, homoz. | Yes |
| C2 (this report) | P91 | México | c.[210delC] | p.[Phe71SerfsTer46] | SN deletion/frameshift, homoz. | Yes |
| C3 (this report) | P92 | México | c.[210delC] | p.[Phe71SerfsTer46] | SN deletion/frameshift, homoz. | Yes |
| C4 (this report) | P93 | México | c.[210del] + c.[481C>T] | p.[Phe71SerfsTer46] + [Arg161Ter] | SN deletion/frameshift + Nonsense (comp.het) | Yes |
| C5 (this report) | P94 | México | c.[210del] + [421del] | p.[Phe71SerfsTer46] + [Trp141GlyfsTer2] | SN deletion/frameshift, comp.het. | No |

NR, not reported.